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THE PHILIPPINE

JOURNAL OF SCIENCE

VOL. XIV MARCH, 1919 No. 3

PELVIMETRY AND CEPHALOMETRY AMONG FILIPINO WOMEN AND NEWBORN BABIES

MADE ON ONE THOUSAND TWO HUNDRED THIRTY-SEVEN CASES[1]

By HONORIA ACOSTA-SISON and FERNANDO CALDERON

(From the Department of Obstetrics, University of the Philippines)

FIVE TEXT FIGURES

This paper is a continuation of the preliminary work which was presented before this Assembly in 1914.[2] Our object is to study in further detail and in a much greater number of cases the normal Filipino pelvis, its difference from the pelvis of the white woman, and its efficiency in obstetrics. In this paper we have increased our investigations. We have determined the available space in the posterior triangle of the pelvic outlet and studied its importance in effective delivery in cases where there is shortening of the intertuberal diameter. Moreover, the size of the full-term newborn child's head, the length of labor, the length of the second stage, and the influence of the weight of the baby and its position on the final outcome of parturition have also been observed.

MATERIAL

Our studies have been made on one thousand two hundred thirty-seven cases of the free obstetrical department of the Philippine General Hospital. For the purpose of investigating the effect of parity on the length of labor and size of the child, the data of the multiparæ were separated from those of the primiparæ. To obviate any error which might exist in the measurements taken by different persons, one of us (H. A. S.)

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[1] Read at the IV Asamblea Regional de Médicos y Farmacéuticos de Filipinas, February, 1918.

[2] Philip. Journ. Sci. § B 9 (1914) 493–497.

exclusively made all the measurements with the exception of those of the diagonal conjugate, which were determined by Doctor Calderon.

METHOD OF MEASUREMENT

The spines, the crests, and Baudelocque's diameter were measured from two different points. One is on the outside of the bone, which is the method practiced by most obstetricians; the data obtained from these measurements are the figures used in comparing these diameters with those of other nationalities. The other point is in the inner boundary of the bone: namely, in the spines, the inner part of the anterosuperior spines; in the crests, the inner border of the ilium; and in the Baudelocque's diameter, the upper border of the symphysis.

The diagonal conjugate had been determined in two ways. One way, which is the method practiced by most investigators on living subjects, is the introduction of the fore and middle fingers into the vagina, reaching thereby the promontory of the sacrum. For one who has a small hand and short fingers, this method is impracticable; so, in the absence of Doctor Calderon, another means had to be thought of that could give just as good, if not better, results. An ordinary uterine sound is bent slightly near its tip to make it correspond with the natural curve of the pelvic canal. With the whole gloved and lubricated right hand in the vagina, the left hand introduces the uterine sound, whose tip is guided by the internal hand to the promontory where it is kept in firm position, while the external hand determines the level on the sound of the lower border of the symphysis pubis. The firmness of the sound and its freedom from any movement that the examining hand may have after the important points have been determined make this method, we believe, give more accurate results. For one who has a small, short hand, this method is of special advantage, for it is easily done and causes relatively less discomfort to the patient.

In the 1917 edition of his text book on obstetrics, Williams has quoted one of us (H. A. S.) as stating that the Filipino pelvis corresponds most closely to that of the American Negress. Since the writer made no such statement, it seems probable that Williams arrived at such a conclusion by comparing the Filipino measurements given by the writer with the Negro measurements reported by Riggs.

While admitting that the measurements given by the writer do correspond in a superficial way with those of the Negress, a closer study shows certain important differences. Such study

TABLE I.—*Pelvic measurements of Filipino women.*

[Measurements are in centimeters.]

Diameter.	Multiparæ; 780 cases.				Primiparæ; 457 cases.			
	Average.		Diameter.		Average.		Diameter.	
	Outside bone.[a]	Inner boundary of bone.	Least.	Greatest.	Outside bone.[a]	Inner boundary of bone.	Least.	Greatest.
Spines	23.74	20.58	15.9	25.0	23.69	20.245	16.0	23.3
Crests	25.4	22.339	19.0	27.0	25.39	22.29	19.1	26.8
Trochanter	-------	27.62	24.1	31.8	-------	27.473	23.0	32.0
Baudelocque's	17.7	16.695	14.1	20.1	17.59	16.32	14.2	19.0
Diagonal conjugate	-------	11.39	10.0	13.0	-------	11.38	9.5	13.0
Outlet anteroposterior	-------	11.058	9.0	13.7	-------	10.95	9.0	13.0
Ischiosacral	-------	9.883	7.5	12.1	-------	9.21	7.7	12.0
Anterior sagittal	-------	5.51	4.0	7.7	-------	5.2	3.8	6.3
Posterior sagittal	-------	8.414	6.1	10.4	-------	8.4	6.0	10.7
Intertuberal	-------	11.111	8.0	14.0	-------	10.7	8.7	13.5

[a] In comparing the Filipino measurements with those of other nationalities, the figures in this column have been used for the spines, the crests, and Baudelocque's diameter.

also shows that the published pelvic measurements most closely corresponding to the Filipino average are not those of the Negress, but those of the average contracted pelvis among white Americans (see Table II).

Here the authors wish to open a new line of investigation by asking a question. Eliminating the varieties of pelves caused by injuries or disease such as rickets, osteomalacia, etc., is it not possible that this average contracted pelvis among white Americans represents not an abnormality, but rather the normal pelvis of the southern European element in the composite American population? The great majority of native-born Americans are of northern European stock, and the southern European element would appear as a minor, or abnormal, type. The great difference between the average Negro pelvis of Riggs and that of the average white American is at once apparent upon the most casual comparison of their measurements. Is it not most natural to suppose, then, that the Asiatic races would present a type or types of pelvis different from both that of the Negro and that of the average white American? It seems to the writers that there is room here for much fruitful investigation.

Anthropologists have discovered that the publication of average measurements is the surest way of concealing rather than of demonstrating racial types. This is particularly true where the people measured are unquestionably of mixed race.

TABLE II.—*Average pelvic measurements of different nationalities.*

[Measurements are in centimeters.]

Diameter.	Normal white American.					"Abnormal" white American; Riggs.			Filipino. Acosta-Sison and Calderon; 1,237 cases.
	Riggs; 707 cases.	Edgar.	Williams.	Huntington.	Cragin.	Rachitic.	Simple flat.	Generally contracted.	
Spines	25.47	25.5	26.0	26.4	26	25.4	25.69	23.75	23.715
Crests	27.998	28.0	29.0	28.2	28	25.7	27.798	25.71	25.295
Trochanters	30.90	31.0	21.0			29.3	30.50	26.28	27.546
Baudelocque's	19.71	20.25		20.7	20	16.98	18.115	17.93	17.645
Diagonal conjugate	12.26	12.15				10.1	10.739	11.128	11.385
Outlet anteroposterior		12.0	11.5						11.004
Ischiosacral									9.546
Anterior sagittal			5.0						5.275
Posterior sagittal			7.5						8.407
Intertuberal	11.0	11.0	10.5						11.405

Diameter.	German?		Irish?	Jew?	Riggs; Negro.				Indian dry pelvis. Emmons; 217 cases.
						"Abnormal."			
	Ahlfeld.	Bumm.	Tweedy.	Jewet.	Normal.	Rachitic.	Simple flat.	Generally contracted.	
Spines	24	26	26	26.5	23.99	23.66	24.01	22.558	22.6
Crests	28	29	29	28.0	26.0	24.4	26.34	24.515	25.7
Trochanters					30.09	28.58	30.53	28.609	
Baudelocque's	19.5 to 20.00	18.2	21	20	19.32	17.31	18.785	18.15	
Diagonal conjugate					12.177	10.63	10.8	10.8	[a] 11.78
Outlet anteroposterior									[b] 11.59
Ischiosacral									
Anterior sagittal									7.56
Posterior sagittal									
Intertuberal									8.0

[a] 9.4 to 14.9 centimeters.

[b] 9 to 14.66 centimeters.

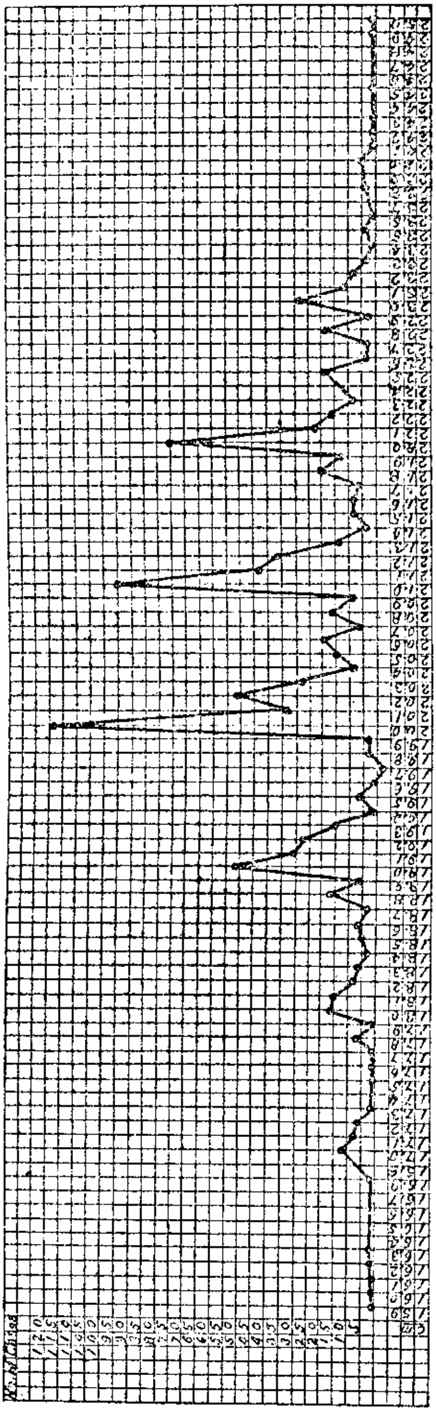

FIG. 1. Interspinous diameter (measured from tip).

The easiest method of bringing out the mixture of types is by plotting measurements in a graphic way, so that the resulting curve will show the proportion or percentage of individual cases of any and all particular types. The measurements of the one thousand two hundred thirty-seven pelves on which the present paper is based have been plotted in such graphic curves. For the whole number of cases the curves for each measurement are shown in figs. 1 to 5.

This investigation has shown that we are able to isolate three major, and two minor, types of Philippine pelvis, as has just been demonstrated. To associate any of these types of pelvis with particular racial varieties of man would be folly in the present state of our knowledge (or rather ignorance) of the other races of Oriental peoples, who surround the Philippines.

Anthropologists believe that the different racial types of India, China, Japan, Polynesia, and Melanesia—in addition to the late Spanish mixture from Europe—have all influenced our composite population. If it were possible to compare the measurements made in our investigation with the considerable series of others from all the different racial types just mentioned, we might hope to arrive at certain tentative conclusions. However, since practically no pelvic measurements from the regions mentioned

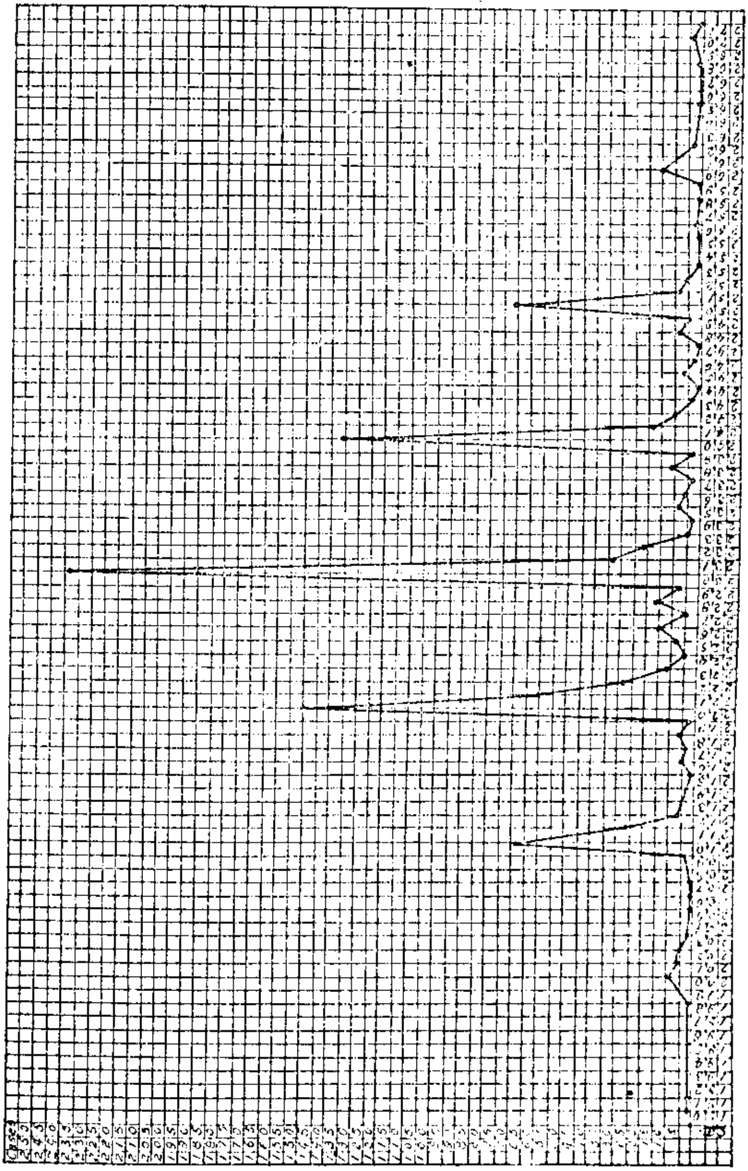

FIG. 2. Intercristal diameter (between upper borders of the iliac bones).

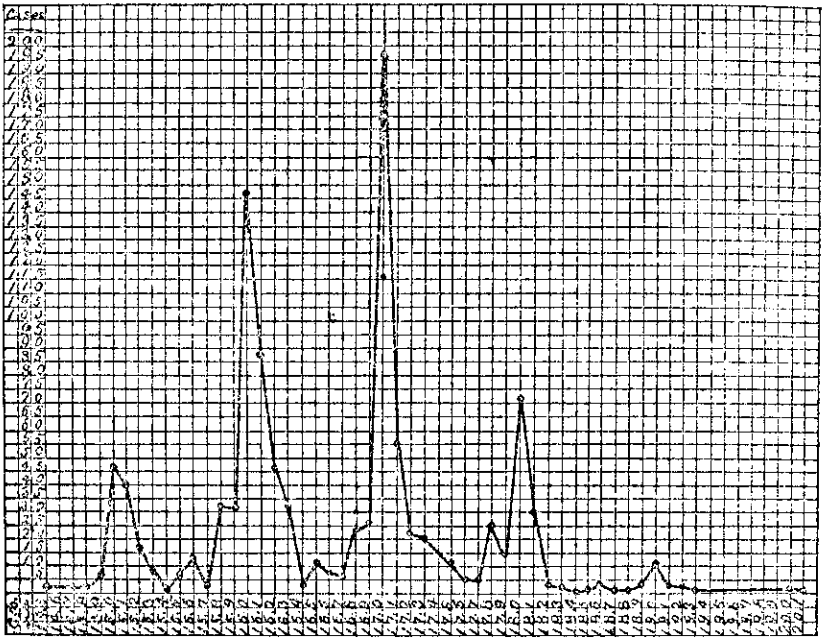

FIG. 3. Baudelocque's diameter.

have been published, the correlation of Philippine types with those of other oriental peoples must await the results of further investigations.[8]

On examining Table III, we find that the diagonal conjugates measuring from 11 centimeters to 12.4 centimeters have the greatest number of cases (which form 85 per cent of the total

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[8] Though unable to draw conclusions from our pelvic measurements, it may be proper to state here that anthropologists have demonstrated from other sources that the predominant Philippine racial types are two: First, a type known as the Indonesian, which came into the Islands from the south and is related to the races of India; and, second, a Mongol-Chinese type, which came into the Islands chiefly from the north. The so-called Malayan Filipinos of to-day are essentially a mixture of these two types, with the addition of certain minor elements. The most important of the latter is a type represented by immigrants from Melanesia. Other minor types are of course the historical immigrations of Chinese and of Spanish Europeans. It is possible, then, that our five pelvic types correspond to these racial elements; though for the present such a conclusion must be regarded as mere speculation. (For discussions of Philippine racial types, see Beyer, Cole, Bean, Koeze, Keane, Montano, and Virchow.)

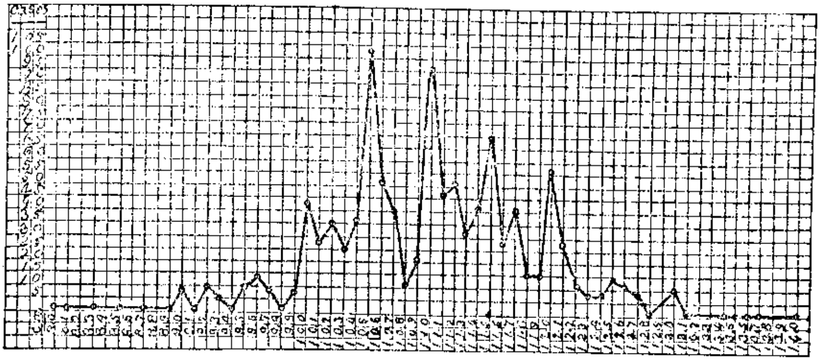

FIG. 4. Intertuberal diameter.

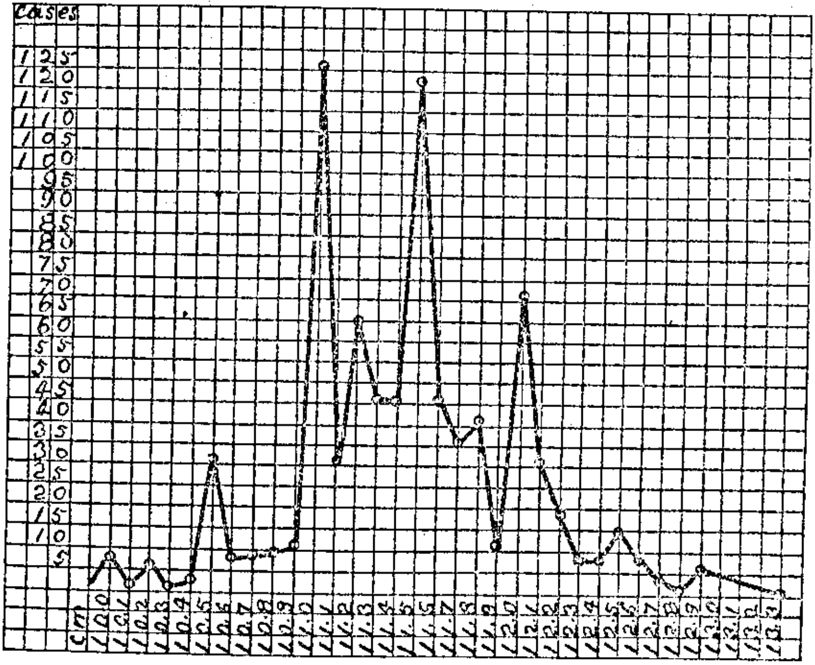

FIG. 5. Diagonal conjugate; primiparæ and multiparæ.

number) and the greatest percentage of spontaneous labor. From this it may be inferred that measurements within these figures represent the normal Filipino diagonal conjugate. The curve, fig. 5, shows that most of the cases have diagonal conjugates of, respectively, 11, 11.5, and 12 centimeters.

TABLE III.—*Diagonal conjugate from the point of view of efficiency and frequency of spontaneous labor in multiparæ; 610 cases.*

Measurement.	Cases.	Average length of labor.		Spontaneous labor.		Operations.	Indications for operation.
cm.		*H.*	*m.*	*P. ct.*	*Cases.*		
10 to 10.4	13	14	10	69.23	9	Podalic version, 2	Uterine inertia.
						Mid forceps, 2	R. O. T., 1. L. O. T., 1.
10.5 to 10.9	50	10	17	92	46	Low forceps, 1	Prolonged second stage to L. M. A.
						High forceps, 1	Prolonged second stage.
						Mid forceps, 1	Uterine inertia.
						Podalic version, 1	Transverse position.
11 to 11.4	225	12	08	92	207	Podalic version, 4	Placenta previa, 2. L. O. P., big head, 1. R. Oc. A., 1.
						Low forceps, 5	Prolonged second stage, 3. Anasarca, 1. L. O. T., 1.
						Mid forceps, 6	R. O. T., 1. R. O. P. with hand prolapse, 1. Prolonged second stage, 4.
						High forceps, 3	Prolonged second stage, 1.
11.5 to 11.9	186	11	30	95.16	177	Low forceps, 2	Prolonged second stage, 1.
						Podalic version, 7	Placenta previa, 1. Big baby, 1. R. O. P., 3. Eclampsia, 1. Prolonged second stage due to concomitant birth of hand with head, 1.
12 to 12.4	107	9	33	97.1	104	Mid forceps, 2	Eclampsia, 1. R. O. P., 1.
12.5 to 13	28	10	18	71.43		Mid forceps, 1	L. O. P., narrow outlet, 1.
						Podalic version, 1	Placenta previa.
13.3	1	7	47				

TABLE IV.—*Diagonal conjugate from the point of view of efficiency and spontaneous labor in primiparæ.*

Measurement.	Cases.	Length of labor.		Spontaneous labor.		Operations.	Indications for operation.
cm.		*H.*	*m.*	*P. ct.*	*Cases.*		
10 to 10.4	9	15	35	88.88	8	Low forceps, 1	Prolonged labor.
10.5 to 10.9	21	18	42	97.76	19	Low forceps, 1 Mid forceps, 1	Do. Do.
11 to 11.4	92	15	11	97.83	90	Mid forceps, 2	Dry labor, 1. Meconium in vagina, (baby presenting by the vertex) 1.
11.5 to 11.9	74	18	50	98.64	73	Mid forceps, 1	Prolonged labor.
12 to 12.4	34	14	52	94.01	32	Mid forceps, 2	Do.
12.5 to 13	5	15	02	100	5		

Comparing Table IV with Table III on the multiparæ, one is struck with the apparently greater percentage of spontaneous labor in primiparæ. The cause of this is that in primiparous cases, our procedure has been to let nature do all it can before instrumental intervention so as to allow sufficient molding of the head. Moreover, many of the operative cases in primiparæ are not shown here for the reason that we made all of our measurements during the puerperium, and in order to avoid infection and relaceration of the repaired wounds, a regrettable occurrence in many of our earlier cases, we refrained from measuring the diagonal conjugate in patients who had been delivered instrumentally.

It is interesting to note, however, that the number of cases whose diagonal conjugate measures between 11 and 12.4 centimeters forms 87 per cent, which is a slightly greater proportion than that of the corresponding measurements in the multiparæ.

PELVIC OUTLET

An effort was first made to determine the relationship of the intertuberal diameter and the length of the second stage of labor, but the results soon demonstrated that this measurement when considered alone is of little significance. In cases of contracted intertuberal diameter where a prolonged second stage was expected it was found that, though the baby was not undersized, oftentimes the duration of the second stage was even shorter than the average normal. In these cases the posterior sagittal diameter had a compensatory lengthening, so that the index of the posterior plane of the pelvic outlet was either normal or larger than normal. This confirms the view of Williams, Daniels, and others, that a contracted intertuberal diameter does not necessarily mean a prolonged or operative labor so long as there is a corresponding lengthening of the posterior sagittal diameter.

Williams has stated that a spontaneous labor is exceptional with the following measurements (head, average size):

Transverse outlet. cm.	Posterior sagittal. cm.
8.00	7.5
7.00	8.0
6.5	8.5
6.0	9.0
5.5	10.0

but that, with these measurements, a safe delivery through the accustomed channel may be effected by instrumental means. Daniels, however, basing his calculations on the average normal measurements reported by Klein—namely, intertuberal diameter, 11 centimeters; posterior sagittal, 9.95 or 10 (Daniels uses 10 instead of 9.95)—has established the following rule: That the index of the posterior plane of the pelvic outlet in normal cases should be 55, as in the following equation:

$$\frac{\text{Intertuberal diameter (11)} \times \text{posterior sagittal (10)}}{2} = 55.0$$

or

$$\frac{\text{Intertuberal diameter} \times x}{2} = 55.$$

This index, according to Daniels, may be as low as 33.3 and no operation needed but perhaps the use of forceps.

Following the formula of Daniels, we find that in Filipino women, the normal index of the posterior plane of the pelvic outlet is much lower than what he considers to be normal for American women. It is

$$\frac{11 \times 8.5}{2} = 46.75 \text{ or } 46.8;$$

and an index as low as 31 may end in spontaneous delivery.

TABLE V.—*The relationship of the index of the posterior plane of the pelvic outlet to the length of the second stage and birth weight of the baby.*

Index of posterior plane of pelvic outlet in multiparæ.	Normal and spontaneously delivered. Cases, 651.	Average length of second stage of labor.	Average birth weight of baby.	Average grams of birth weight of baby per minute of second stage.
		H. m.	*g.*	
31 to 40.9	124	0 57.75	2,879	48.1
41 to 50.9	390	1 00	2,996	49.98
51 to 60.9	126	0 44	3,035	69.0
62 to 74.9	11	0 47	3,041	65.0

On examining Table V one notices the close relationship between the weight of the baby, the index of the posterior plane, and the length of the second stage of labor.

TABLE VI.—*Cases with prolonged second stage of labor; 43 cases; not included in Table V. Multiparæ.*

Index of the posterior plane of pelvic outlet.	Cases	Average length of second stage of labor.	Average birth weight.	Average grams of weight per minute of second stage.	Complications.	Operations.
		H. m.	*g.*			
31 to 40.9	10	3 54	3,133	13.4	Prolapse of hand with vertex, 1 Placenta previa, 1 L. O. P., 1 R. O. T., 1 L. O. T., 1 Prolonged labor, 5	Mid forceps, 1. Low forceps, 7. Podalic version, 1.
41 to 50.9	25	2 44	3,089	18.8	R. O. P., 8 L. O. P., 2 Placenta previa, 1 R. O. T., 1 Transverse position, 1 L. M. A., 3 Prolapse arm with vertex, 1 Uterine inertia, 1 Dry labor, 1 Prolonged labor, 3	Podalic version, 1. Mid forceps, 5. Low forceps, 3.
51 to 67.9	8	2 10	[a] 3,448	26.5	R. O. P., 4 Placenta previa, 1 Big baby, 3	Podalic version, 5.

[a] One baby weighed 6,320 grams.

The close relationship of the baby weight and malposition or malpresentation with the length of the second stage and the size of the index of the posterior plane of the pelvic outlet is here emphasized.

TABLE VII.—*Cephalic measurements in multiparæ and primiparæ; total cases, 1,237.*

[Measurements are in centimeters.]

Measurement.	Multiparæ, 780 cases.			Primiparæ, 457 cases.		
	Average.	Least.	Greatest.	Average.	Least.	Greatest
Occipito-mental diameter	12.78	11.1	14.5	12.77	11.0	14.4
Occipito-frontal diameter	11.29	9.8	13.5	10.88	9.5	12.1
Suboccipito-bregmatic diameter	9.614	8.2	10.9	9.39	8.4	10.5
Biparietal diameter	9.031	7.6	10.2	8.9	7.9	10.0
Bitemporal diameter	7.992	6.9	9.0	7.89	7.1	9.1
Occipito-mental circumference	36.711	30.9	43.4	36.5	33.0	41.2
Occipito-frontal circumference	33.189	28.7	[a] 40 [b] 38			
Occipito-bregmatic circumference	31.158	27.3	35.8			

[a] L. M. A.

[b] L. O. A.

Table VII shows a slight diminution of the cephalic diameters in primiparæ as compared with those of the multiparæ. This

TABLE VIII.—*Showing the relative duration of labor and length and weight of babies in multiparæ and primiparæ; 1,237 cases.*

	Multiparæ, 780.			Primiparæ, 457.		
	Average.	Least.	Greatest.	Average	Least.	Greatest.
Age ... years	27.07	16	45	18.37	15	45
Length of labor, spontaneous L. O. A ... hrs. min	9.01	1.00	48.00	16.00	4.20	72.00
Length second stage spontaneous L. O. A ... do	0.52	0.05	4.00	2.12	0.15	4.00
Length of baby, female; 360 of multiparæ ... cm	48.98	44	53	48.96	44	51
Length of baby, male; 420 of multiparæ ... cm	49.35	48.0	65			
Weight of baby, female, grams	2,972.59	1,700	4,500	2,728	1,260	4,130
Weight of baby, male ... do	3,039.08			2,831		
Weight of baby, both sexes ... do	3,005.83	1,700	4,500	2,831	1,260	4,130
Weight of babies of both sexes whose mothers stayed more than one week in hospital before parturition ... do	3,144					

diminution is most marked in the fronto-occipital and suboccipito-bregmatic diameters whereas the mento-occipital diameter is almost the same in both cases.

The figures in Table VIII are self-explanatory. As in other nationalities, the multiparæ have a shorter duration of labor, and longer and heavier babies than those of the primiparæ; also, the female babies are smaller than the male. The influence on the birth weight of the baby of a week's sojourn in the hospital before confinement is here well shown. The difference in the average birth weight of the babies whose mothers stayed one week or more in the hospital before parturition and those whose mothers entered the hospital on the day of, or a few days before, confinement is 139.35 grams in favor of the former.

TABLE IX.—*Average length of labor and duration of second stage in normal spontaneous deliveries in multiparæ. These form 92.807 per cent of 780 cases of multiparæ.*

Position.	Cases.	Length of labor.						Length of second stage.					
		Average.		Least.		Longest.		Average.		Shortest.		Longest.	
		H.	*m.*	*H.*	*m.*	*H.*	*m.*	*H*	*m*	*H.*	*m.*	*H.*	*m.*
L. O. A	614	9	01	1	00	48	00	0	52	0	10	4	00
R. O. A	75	12	05	2	00	48	00	1	02	0	15	3	00
L. O. P	5	23	34	6	40	60	00	1	33				
R. O. P	13	28	55	4	20	72	00	1	31	0	20	3	00
R. O. T	6	27	14	7	00	72	00	1	40	0	40	3	00
Breech presentation	7	10	38	8	00	15	00	1	18	0	20	0	20

From Table IX it is evident that, as in women of other countries, the duration of labor and of the second stage in anterior vertex presentations is shorter than in the posterior or transverse vertex presentations. Moreover, the length of labor in left occipito-anterior position is shorter than the duration of normal labor as taught in most American obstetrical text-books.

The data in Table X indicate that the frequency of the different fœtal presentations is much the same as in other countries; only that, in vertex presentations, there is a relatively high percentage of those which occur in the left, those occurring in the right being correspondingly diminished.

The twenty-seven Cesarean sections performed in the obstet-

TABLE X.—*Frequency of various presentations and positions in the 780 cases of multiparæ.*

	Number.	Per cent.
Vertex presentation:		
L. O. A	634	84
R. O. A	82	10.9
L. O. P	7	0.93
R. O. P	17	2.26
R. O. T	9	1.19
L. O. T	3	0.39
Total	752	96.41
Face presentation	2	0.256
Transverse position	6	0.76+
Breech presentation	20	2.36+

TABLE XI.—*Operations in multiparæ.*

Operation.	Cases.	Position.	Cases.	Average length of— Labor.		Average length of— Second stage.	
				H.	*m.*	*H.*	*m.*
High forceps	2	L. O. A	1	17	00	4	30
		R. O. A	1				
Mid forceps	12	L. O. A	4	17	38	2	31
		R. O. A	2				
		L. O. P	1				
		R. O. P	3				
		L. O. T	1				
		R. O. T	1				
Low forceps	13	L. O. A	9	26	36	3	12
		L. M. A	1				
		L. O. T	2				
		L. O. P	1				
Podalic version	20	Transverse position	6	15	30	1	40
		L. O. A., placenta previa	4				
		L. O. A., vertex born with hand	1				
		L. O. A., uterine inertia, big head	1				
		R. O. A., placenta previa	4				
		Brow	1				
		R. O. P	1				
		R. O. T	2				
Breech extraction	13	R. S. A	4	11	38	0	47
		L. S. A	6				
		L. S. P	3				

TABLE XII.—*Operations in primiparæ.*

Operation.	Cases.	Position.	Cases.	Average length of—			
				Labor.		Second stage.	
				H.	*m.*	*H.*	*m.*
Low forceps	21	L. O. A	11	22	26	3	32
		R. O. A	1				
		L. O. P	2				
		R. O. P	3				
		L. O. T	2				
		R. O. T	2				
Mid forceps	21	L. O. A	11	32	34	4	09
		R. O. A	1				
		R. O. P	1				
		L. O. T	6				
		R. O. T	3				
Podalic version	2	L. Ac. A	1	5	15	2	30
		L. Ac. P	1				
Breech extraction	7	L. S. A	4	13	05	1	33
		R. S. A	3				

rical department of the Philippine General Hospital and one other similar operation performed at another hospital (Roxas) are not included in this report, for only those cases whose babies were born alive per vaginam were measured. Moreover, in all Cesarean sections made on Filipino women, only on two occasions was the disproportion of pelvis and child the indication. One was a case of a primipara whose baby had an enormously large hydrocephalic head whose mento-occipital diameter measured 19 centimeters; and the other, a case of osteomalacia (Roxas). The rarity of instances in which pelvic contraction, other than that caused by osteomalacia (which was found only once), can be an indication to Cesarean section is emphasized by the fact that of the twenty-seven Cesarean sections performed in the Philippine General Hospital prior to April, 1918 (Rustia), twenty-four were performed on Filipinas for an indication (except in the case of the primipara with a hydrocephalic fœtus, if that should be excluded) other than the disproportion between the fœtal head and the pelvis or pelvic contraction. Whereas the only Cesarean sections performed on American private patients (three cases) were necessary on account of dystocia caused by contracted pelvis.

CONCLUSIONS

1. The Filipino pelvis is of a type different from either the white American or the Negro pelvis, and its average normal measurements are similar to those of the generally contracted pelvis of the white American.

2. The index of the posterior pelvic plane in cases of contracted intertuberal diameter is important in the determination of the probable outcome of labor.

3. Contracted pelvis, except in cases of osteomalacia, is rarely an indication to Cesarean section among Filipino women.

4. There is practically no difference in the measurements of the pelvic diameters of multiparæ and primaparæ.

5. The newborn babies of multiparæ are longer and heavier than those of the primiparæ.

6. The babies of mothers who stayed in the hospital for one or more weeks before delivery are heavier than those whose mothers entered the hospital at the time of labor.

7. The male babies are in greater number and are longer and heavier than the female babies.

8. Labor is longer in primiparæ than in multiparæ.

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ILLUSTRATIONS

TEXT FIGURES

IG. 1. Interspinous diameter (measured from tip).
2. Intercristal diameter (between upper borders of the iliac bones).
3. Baudelocque's diameter.
4. Intertuberal diameter.
5. Diagonal conjugate, primiparæ and multiparæ.

THE LUMBANG-OIL INDUSTRY IN THE PHILIPPINE ISLANDS

By R. H. Aguilar

(*Bureau of Science, Manila*)

The manufacture of lumbang oil in a crude way antedates existing records. It has been mostly carried on by Chinese, who have made no attempt to improve the methods of production, and the oil that they express is dark in color and of a disagreeable odor.

The oil industry in the Philippine Islands is undergoing a radical change, for the manufacturers have adopted the motto of larger production and better quality. Some of the large local concerns, hitherto devoting themselves exclusively to the manufacture of coconut oil, are now turning their attention to other oils, among which lumbang holds an important place. There are several points to be taken into consideration, if the quality of the latter is to be improved and the industry placed on a commercial basis. The object of this paper is to discuss some of these points with a view to more profitable production.

There are two kinds of lumbang nuts known in the Philippine Islands from which oils are obtained; lumbang bato (*Aleurites moluccana*)[1] and lumbang banucalag (*Aleurites trisperma*). Lumbang bato is of wider distribution, more abundant, and better known than lumbang banucalag, and the attention of manufacturers at present is devoted to the production of oil from the former. Lumbang banucalag is almost unknown in the Manila market, and when the word "lumbang" is employed it is generally taken to mean lumbang bato. The Chinese, who are the largest dealers in lumbang oils,[2] are not willing to handle the banucalag variety, because it is supposed that contact causes skin eruptions;[3] but, in my opinion, there is no foundation for this belief.

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[1] Richmond, G. F., and Rosario, M. V., Philip. Journ. Sci. § A 2 (1907) 441–443.

[2] For further data see Brill, H. C., and Agcaoili, F., Philip. Journ. Sci. § A 10 (1915) 113.

[3] Aguilar, R. H., Philip. Journ. Sci. § A 12 (1917) 236.

The supply of banucalag nuts is irregular and until a definite supply can be depended upon, the extraction of oil from these nuts would hardly be profitable as a separate industry; but no doubt it could be carried on profitably in connection with the extraction of lumbang bato oil. The close similarity[4] between lumbang banucalag oil and Chinese wood oil, and the fact that the latter is so highly appreciated[5] by United States paint manufacturers, constitute inducements for the production of banucalag oil.

Both varieties of lumbang fruits mature and drop from the trees in June and July, and the best time for gathering them is during July and August. Information obtained from local Chinese merchants indicates that the gathering of lumbang nuts could be much extended in Mindanao, more especially in the Davao Gulf district, where the nuts are known by the name "biao," and where now large quantities go uncollected.

Heretofore, merchants have hesitated to invest capital in the lumbang-oil industry for they believed insufficient nuts could be obtained to warrant the establishment of a factory. On the other hand a Manila firm in September, 1910, wrote with regard to this oil:

> With proper attention the Philippines would be in a position to export the oil profitably. Proper machinery installed near San Pablo, Laguna, would make profitable a large export business, for there seem to be sufficient lumbang seeds that could be secured from Laguna, Tayabas and Batangas provinces.

An estimate of the yearly Philippine crop of lumbang nuts is very difficult to make. It would not be legitimate to base such on the annual production of lumbang oil, because the portion of the crop now used for oil manufacture is very small. In 1911 one manufacturer claimed that there was a sufficient available supply with proper machinery to produce 5,000 kilograms of oil per day; this amount would represent about 9,000 kilograms of kernels or about 26,000 kilograms of dry unshelled nuts. On this basis the available nuts would supply a modern oil factory with a monthly capacity of 234 metric tons of nut kernels. The Bureau of Forestry is encouraging the planting of lumbang trees throughout the Archipelago, and it is estimated that approximately a half million trees are being planted annually. Therefore, an increasing supply of raw material for the manufacture of lumbang oil is assured. The number of lumbang trees in the Islands is not definitely known, but the information at hand would seem to indicate that it is possible to secure an abundant supply of lumbang nuts and to make of the lumbang-oil industry a profitable business.

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[4] Richmond, G. F., and Rosario, M. V., Philip. Journ. Sci. § A 2 (1907) 443.

[5] Drugs, Oils, and Paints 30 (1914) 207.

In the purchase of lumbang nuts care should be taken to base the price upon the dry nuts. Freshly gathered nuts, especially lumbang banucalag, contain from 10 to 22 per cent of moisture. The moisture content can be estimated as follows:

For lumbang bato, take about 1 kilogram or more of representative nuts, and place them in an oven at 90° C. to 95° C. for from two to three hours.

For lumbang banucalag, the same quantity may be taken, but the temperature should be carefully regulated between 65° C. and 70° C. for ten hours or more. This is extremely important, as the kernels of the banucalag nuts harden slightly and assume a darker color at a higher temperature.

Lumbang bato nuts may be stored for a year or more in a cool dry place without their undergoing an appreciable change in the amount or the composition of the oil; but lumbang banucalag nuts stored for the same length of time, probably due to oxidation, will be greatly affected in both the amount and the composition of the oil, with an increase in its acidity. No mold or fungus was observed on any of the nuts stored. Due to the comparatively thin shell the kernels of lumbang banucalag nuts can be easily separated from the shell after cracking; but considerable difficulty was experienced in trying to find some adequate means of separating the kernel from the shell of lumbang bato nuts; nuts gathered over a year ago showed, when opened, that the kernel still adhered firmly to the shell. Steaming has been used successfully with certain varieties of coconuts, but is unsuccessful in this case and, furthermore, darkens the kernel and the oil. The commonest procedure now in use is to crack the nuts and pick out the kernels by means of a pointed instrument, a very tedious operation.

LUMBANG BATO (ALEURITES MOLUCCANA)

Biau (Misamis, Davao); *lumbang* (Rizal, Laguna, Zamboanga, Batangas); *lumbang bato* (Cavite). Lumbang is the name officially adopted by the Bureau of Forestry.

The fruit of *Aleurites moluccana* is fleshy, ovoid, dark, dull green, 5 to 6 centimeters long, and contains one or two seeds. The seed is about 3 centimeters long and 2.5 centimeters broad. It has a very hard, rough, rigid shell about 2.5 millimeters thick.

This contains a white, oily, fleshy kernel consisting of a very thin embryo surrounded by a large endosperm. This is in turn covered by a thin, white, papery seed coat. This thin seed coat adheres firmly to both the shell and the kernel, so that the kernel is separated from the shell with difficulty.

The importance of lumbang bato oil has been known since 1873 when Prof. Julius Wiesner,[6] reporting on The Foreign Plant Stuffs in Industrial Use at the Vienna Universal Exhibition in that year, said:

> A source of oil not hitherto regarded by the European oil industry is the Bankul nut (from Aleurites triloba), which deserves to be brought into use, on account not only of the low price of the raw material, but also from the high quality of the oil.

In the Philippines the oil is now being used in the caulking of vessels, in the manufacture of soft soaps, and as a substitute for linseed oil in the local manufacture of paints; also there is a demand much in excess of the present production for this oil from United States paint manufacturers. Therefore, the great value of the oil for industrial purposes is now well established, and its extraction based upon a more systematic method should be carefully considered.

Among the various procedures now in use for the purpose of minimizing the work involved in removing the kernel from the shell of lumbang bato nuts, none of which has been found wholly satisfactory, are the following:

In some localities the Chinese place large quantities of nuts on the ground, cover them with straw and after burning the straw immediately sprinkle the nuts with cold water. They claim that with this method the nuts burst. In Laguna, Tayabas, and Batangas Provinces, the nuts are placed in tanks of boiling water and left there for from five to six hours. This loosens the kernel, and when sufficiently cool the nuts are cracked and the kernels are separated from the shells. These two methods produce brown kernels from which only brown oil can be expressed.

In Moro Province, along the coast of Davao, the nuts are dried in the sun until the kernels loosen sufficiently, which may be ascertained by occasionally cracking a few nuts for trial. The drying takes from five to ten days or more, depending upon the condition of the weather; the nuts are then cracked and the kernels removed. This process is very slow, although the kernel usually comes out whole and is of the best quality.

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[6] Andes, L. E., Vegetable Fats and Oils, 2d ed. Greenwood and Co., London (1902) 6.

The method that has been developed in the Bureau of Science laboratory reduces somewhat the time and the labor involved in the preparation of the kernel and has no injurious effect on the oil. The nuts were heated in an oven at 95° C. for from three to four hours, dumped rapidly into cold water, and left overnight. The next morning the shells had burst, and the kernels were separated without difficulty.

To eliminate the time and labor involved in removing the kernel from the shell, it has been suggested to crush and grind the nuts, and then press the oil from the ground mixture of shell and kernel. This procedure has been tried in several places and seems to be reasonable from the standpoint of economy of time and labor; however, I am more inclined to favor the method of extracting the oil directly from the kernel, because (a) about 20 kilograms more oil per ton of nuts can be recovered from separated kernels than when the shell is ground with them, and (b) the fertilizing value of the cake, which Chinese manufacturers now sell at a good profit, will be very much reduced when shell is included in it, as will be shown later.

An idea of the commercial advantage of either of these methods over the other can be obtained by comparing the product of one factory utilizing kernels with that of another factory utilizing nuts for the expression of oil.

Before describing these two methods of procedure, it is interesting to note the variation existing in the kernel content of the different lots of lumbang bato nuts from Cavite Province. This variation is probably due to the age of the nut-bearing trees and the length of time the nuts lay uncollected on the ground.

TABLE I.—*Moisture content of nuts and percentage of kernels referred to the weight of dry nuts.*

[illegible]	Moisture in nuts.	Dry nuts.	Kernels from dry nuts.	Kernels in dry nuts.
[illegible]	P. ct.	g.	g.	P. ct.
[illegible]	19	2,430	845	34.77
2,000	22	1,560	561	35.96
[illegible]		2,000	676	33.80
[illegible]		2,000	652	32.60
[illegible]		2,000	685	34.25
[illegible]	10	1,800	589	32.73
Average				34.02

In November, 1918, the price in Manila of lumbang bato nuts was 50 pesos per ton; kernels, 244 pesos per ton; and oil, 8.66

pesos per 5-gallon gasoline can. The average weight of 18.927 liters (5 gallons) at ordinary temperature (30° C.) is 17.33 kilograms.

Using the above data as a basis of calculation the following results are obtainable for 1 metric ton of kernels:

(1) *Factory utilizing nut kernels for the expression of oil.*

	Pesos.
Yield, 560 kilograms of oil, expressed at a pressure of 800 kilograms per square centimeter; selling at 8.66 pesos per can	279.83
Yield of press cake, 440 kilograms; selling at 25 centavos per kilogram	110.00
Total	389.83
Cost of 1 ton of kernels	244.00
Gross profit	145.83

(2) *Factory utilizing whole nuts crushed for the expression of oil.*

	Pesos.
Yield 501.24 kilograms of oil, 20 kilograms of oil per ton of nuts less than in the former process, at a pressure of 800 kilograms per square centimeter; selling at 8.66 pesos per can	250.47
2.938 tons of nuts (based on the average given in Table I), necessary to produce 1 ton of kernels, at 50 pesos per ton	146.90
Gross profit	103.57

The fertilizing value of the cake from this process is very much reduced, as is shown in Table III. It is doubted if a market for it can be obtained; furthermore, the oil from this process, while the same chemically, is relatively dirtier and harder to clarify than is that from the former.

The above results conclusively show the advantage of the first method over the second from a commercial standpoint, especially until a definite market is established for the cake from the latter. As many factors enter into any calculation of the cost of operation, it is difficult to furnish approximate and satisfactory data for the two processes. If the two factories were to operate in the same locality, under identical conditions, there is no doubt that the cost of production for the first factory would be relatively less. One large item of expense would lie in the fact that a factory utilizing nuts would need heavier crushers and larger presses and consequently more power, besides having to handle a greater bulk of material, thus lowering the daily output of oil and the general efficiency of the whole system.

To form an idea of the quality of the lumbang kernels sold in the market at prices ranging from 18 to 19 pesos per 75 kilograms, four different samples were secured from which the oil was expressed and analyzed; the results obtained are presented in Table II.

TABLE II.—*Quality of kernels sold in Manila.*

Sample No.	Kernel color.	Oil.		
		Based on kernel.	Color.	Acid value.
		P. ct.		
1	Light	55	Light colored	[a]7.63
2	Brown	50	Light brown	[a]24.75
3	do	51	Brown	[a]66.53
4	do	52	do	[a]72.28

[a] Milligrams KOH used to neutralize 1 gram of the oil.

Table III shows an analysis of oil expressed from fresh kernels as compared with two grades of oil obtained from the market.

TABLE III.—*Constants of three samples of oil.*

	Oil expressed from fresh kernels.	Oils obtained from the market.	
		Grade I.	Grade II.
Appearance	light colored	brown	dark brown
Specific gravity at 15.5° C	0.9261	0.9253	0.9237
Saponification value	188	193	194
Iodine number	154	157	160
Acid number	0.55	64.25	106.48

The results shown in Table III indicate clearly that the preparation of the kernel is one of the most important points to be taken into account in the manufacture of lumbang oils. Prolonged heating at high temperatures produces brown kernels, and consequently a brown oil that is high in free fatty acid, as shown by the acid values of samples 2, 3, and 4, in Table II. Long storage of the kernel also causes deterioration in the value of its oil content; for it is readily attacked by small black beetles, thus reducing the available amount of oil; and the oil content becomes more and more acid without any perceptible change in the appearance of the kernel or in the oil extracted. Sample 1, Table II, has the same appearance as the ker[illegible]red in the laboratory. Freshly prepared kernel, th[illegible]e best material for the expression of oil.

To determine the change i[illegible] fatty acids.

the oil content of kernels due to storage, a sample of fresh kernels was secured and divided into two portions. The first portion was expressed immediately and gave an oil with an acidity of 0.55. The second portion was stored in a cool, open, dry place for a month, when the oil was expressed, and found to have an acidity of 5.32. The fertilizing value of the cake from the kernels as well as that of cake obtained from crushed nuts are shown in Table IV.

TABLE IV.—*Fertilizing value of lumbang bato cake from kernels and crushed nuts.*

	Cake from kernels.[a]	Cake from crushed nuts.[b]
	Per cent.	*Per cent.*
Moisture	11.13	8.46
Nitrogen (N_2)	8.86	1.25
Potash (K_2O)	1.67	0.68
Phosphorus (P_2O_5)	1.02	0.25

[a] Price in November, 1918, 25 centavos per kilogram. [b] No market established.

LUMBANG BANUCALAG (ALEURITES TRISPERMA)

Baguilumbang, balucalad (Laguna); *banucalag, lumbang banucalag, lumbang gubat* (Cavite); *balucanag* (Batangas); *lumbang* (Oriental Negros, Camarines). Baguilumbang is the name officially adopted by the Bureau of Forestry.

The fruit is 5 to 6 centimeters in diameter, somewhat rounded and obscurely angled, usually 3-celled, the cells 1-seeded, tardily dehiscent. The seed is somewhat ellipsoid, slightly flattened, brown, rather smooth, and has a rather brittle shell about 0.5 millimeter thick. This contains a white, oily, fleshy kernel, consisting of a very thin embryo surrounded by a large endosperm. This in turn is covered by a thin, white, papery seed coat. When dry the kernel with the thin seed coat shrinks slightly away from the shell so that the shell and the kernel are easily separated.

The close similarity between Chinese wood oil and lumbang banucalag oil[7] and the important place Chinese wood oil is now occupying in the paint industry of the world,[8] clearly show the industrial possibilities of banucalag oil.

The kernel of lumbang banucalag nuts is not so difficult to separate from the shell as is that of lumbang bato. When the

[7] Richmond, G. [illegible] Rosario, M. V., Philip. Journ. Sci. § A 2 (1907) 3.

[8] Wilson, E. H. [illegible] al Imp. Ins. 11 [illegible] 918) 13, 454.

nut is dry the kernel shrinks somewhat, and it can be easily separated after cracking the shell. No banucalag kernels are being sold in the market, and the industry of lumbang banucalag at present is very limited. This may be due to two important reasons, namely:

(1) The banucalag kernels when stored undergo a change, probably due to partial oxidation, as the result of which the oil becomes much more difficult to express and assumes a darker color.

(2) The banucalag oil when expressed, unless kept in air-tight containers, becomes rancid and foul smelling.

These facts constitute the main drawbacks to the production of lumbang banucalag oil; but, if certain precautions are strictly followed, there is no doubt that the industry of lumbang banucalag oil in connection with lumbang bato oil may become a profitable enterprise.

Freshly gathered nuts, free from moisture, produce kernels of the best quality, and the yield of oil by expression at 800 kilograms per square centimeter may be as much as 56 per cent of the weight of the kernels. This amount represents about 35 per cent of the weight of the dry nuts, whereas the oil obtained from lumbang bato kernels represents only about 19 per cent. The banucalag oil so prepared is of very good quality, light amber in color, and altogether satisfactory in its physical and chemical properties. If the oil is placed in air-tight containers while fresh, it will keep longer and no appreciable change in its composition will be noticed. On the other hand, unshelled nuts that were kept for sixteen months underwent so great a change in their oil value that the yield by expression was reduced from 56 per cent to 40 per cent of the weight of the kernel, and the oil was high in free fatty acids and much darker in color. The results obtained are shown in Table V.

TABLE V.—*Constants of banucalag oil.*

	Oil expressed from the kernels of fresh nuts.	Same oil after being kept for 16 months in a well-stoppered bottle.	Oil expressed from the kernels of nuts stored in a sack in a cool dry place for 16 months.
Per cent of oil based on the weight of kernels	56	----------	40
Color of oil	light amber	amber	dark amber
Specific gravity at 15.5° C	0.9362	0.9385	0.9441
Saponification value	191	192	200
Iodine value	166	170	160
Acid value	2.22	5.51	49.14

The results shown in Table V demonstrate conclusively the advisability of expressing the oil from the kernels of freshly gathered nuts, and of avoiding as much as possible long storage. These precautions should be strictly followed to ensure the production of a clear, light-colored oil, low in free fatty acids. The properties that make this oil so sensitive are the ones that make it valuable. The excellent drying qualities of this oil have been already reported.[9]

Lumbang banucalag nuts may be crushed and finely ground in an oil mill and the oil expressed directly from the crushed nuts. However, this procedure is even less commendable than in the case of lumbang bato; in the first place, the oil thus obtained is dirty, highly contaminated with shell particles, and darker colored; in the second place, the acid value is relatively higher, as shown in the following test:

From one sample lot of banucalag nuts two samples of oil were taken; in one case the oil was expressed from the kernel after separating the shell, and in the other case from the crushed nuts without separating the shell from the kernel. After one week the sedimentation by gravity was complete, and the two samples of oil were clear. The acid value of the first was 3.65; that of the second, 10.65.

The better quality of oil obtained when extraction was made from the kernels fully justifies the relatively small amount of additional work required to separate the kernel from the shell of lumbang banucalag nuts. Clear oil may be obtained, either by sedimentation or through filter presses, and kept in air-tight containers for storage.

The fertilizing value of lumbang banucalag cake compares very favorably with that of lumbang bato cake, as will be seen by a comparison of Tables VI and IV.

TABLE VI.—*Fertilizing value of lumbang banucalag cake from kernels and crushed nuts.*

	Cake from kernel.	Cake from crushed nuts.
	Per cent.	*Per cent.*
Moisture	7.67	9.45
Nitrogen (N_2)	6.20	2.99
Potash (K_2O)	1.79	0.90
Phosphorus (P_2O_5)	1.13	0.95

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[9] Aguilar, R. H., Philip. Journ. Sci. § A 12 (1917) 235.

SUMMARY AND CONCLUSIONS

The lumbang oil industry, if properly developed, will become a profitable business.

It is much less desirable for a factory devoted to the manufacture of lumbang oils to purchase kernels than the nuts from which to prepare its own kernels, because oil from kernels that are being sold in the market is almost always of lower grade than that from freshly prepared ones.

No appreciable change can be noticed in the available oil content of uncracked lumbang bato nuts stored for over a year; but the content and the quality of the oil of unshelled banucalag nuts stored for the same length of time is considerably reduced. In the latter case even the shell is insufficient to protect the oil in the kernel from oxidization by the air, and shelled kernels deteriorate very rapidly.

Both oils after expression may be kept satisfactorily in proper containers. In view of these facts, a lumbang-oil factory engaged in the commercial expression of both bato and banucalag oils, in order that the maximum yield and best quality of both bato and banucalag oils may be obtained, preferably should commence the season with the expression of banucalag oil and store the bato nuts until the other species is finished.

NEW PHILIPPINE GALL MIDGES

By E. P. FELT

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This paper is supplemental to an earlier one;[1] it not only describes and records the food habits of a number of Philippine gall midges, but also establishes the occurrence in the eastern tropics of *Ctenodactylomyia* Felt or a closely related genus, previously known only in subtropical America. This was to be expected, since studies on distribution show that certain subtropical genera have a range which would suggest their probable occurrence in all warmer climates where food plants permit their existence. This record is analogous to the discovery of species of the genus *Aplonyx* in such widely separated parts of the world as the Mediterranean region and the vicinity of Salt Lake, Utah—localities apparently agreeable to the host plants as well as to the insects.

This collection, like the preceding, was received through the courtesy of Prof. Charles S. Banks, chief of the department of entomology of the College of Agriculture, University of the Philippines, who collected some of the species, as detailed below. Mr. L. B. Uichanco reared a number of species from various galls; the galls, I understand, are to be described in detail in another paper.

Ctenodactylomyia antidesmæ sp. nov.

Female.—Length, 1.5 millimeters. Antennæ extending to the base of the abdomen, sparsely haired, reddish brown, the basal segments reddish orange, probably of 14 segments, the fifth cylindrical, its length two and one-half times its diameter. Palpi presumably triarticulate, first segment irregularly and broadly oval, second a little longer, slenderer, third three times as long as its width and somewhat dilated. Eyes black, holoptic. Mesonotum pale yellowish, sparsely clothed with coarse setæ. Scutellum translucent yellowish. Postscutellum yellowish orange. Abdomen reddish orange, distal segments rather thickly clothed with coarse, dark setæ or scales. Wings hyaline, their length about twice their width, third vein uniting with margin well before apex, fifth vein obsolescent distad and joining margin at distal fourth, its branch near basal third. Membrane rather thickly clothed with dark hairs. Halteres whitish transparent basad, fuscous apicad. Coxæ and femora basad yellowish orange. Femora distad and tibiæ dark straw. Tarsi mostly fuscous, the anterior pair with narrow, indistinct, yellowish annulations at articulations. Claws quadridentate, there being at least three minor stout teeth nearly as long as, though more slender than, the main claw. Pulvilli about one-half length of claws. Ovipositor about one-half length of abdomen. The terminal lobes five times as long as wide and sparsely setose.

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[1] Felt, E. P., New Philippine gall midges, with a key to the Itonididæ, *Philip. Journ. Sci.* § D 13 (1918) 281.

Type.—Cecid. a2881, New York State collection.

LUZON, Laguna Province, Mount Maquiling, October 2, 1917, College of Agriculture accession No. 18157 (*L. B. Uichanco*).

The single female, described above, was reared from leaf galls on *Antidesma leptocladum* Tul. The species is tentatively placed in this genus, though the wings are decidedly broader than in the type species, and there is a possibility that it should be referred to a new genus. Such action is deferred until both sexes can be secured.

Lasioptera falcata sp. nov.

Female.—Length, 1.5 millimeters. Antennæ extending to near base of abdomen, sparsely haired, dark brown, of 24 segments, the fifth as long as its diameter. Terminal segment slightly produced and narrowly oval. First segment of palpi short, irregular; second about three times as long as its diameter; third nearly one-half longer, slenderer; fourth a little longer and slenderer than third. Mesonotum reddish brown, apparently denuded. Scutellum reddish orange. Postscutellum dark brown. Abdomen mostly dark brown, first segment margined caudad with a narrow white line, the others though badly rubbed show submedian whitish spots; terminal segment yellowish. Wings hyaline, third vein uniting with costa near distal third. Halteres yellowish. Coxæ yellowish orange. Legs mostly dark brown. Ovipositor nearly as long as body, terminal lobe about four times as long as wide, slightly curved, sparsely setose, and with an oval group of heavy, stout, hastate spines basad and a group of rather long, moderately slender, chitinous hooks.

Type.—Cecid. a2887, New York State collection.

LUZON, Laguna Province, Los Baños, January 3, 1917, College of Agriculture accession No. 18183 (*Uichanco*).

The single female, reared from a stem gall on a wild cucurbit, is presumably undescribed, and there is little question that it is the producer of the gall. The insect is remarkable because of the unusually long, somewhat falcate, terminal lobes of the ovipositor.

Asphondylia grewiæ sp. nov.

Male.—Length, 1.5 millimeters. Antennæ probably nearly as long as body, sparsely haired, basal portion, at least, dark brown, presumably of 14 segments, fifth with a length four times its diameter and with moderately high circumfila. Palpi probably triarticulate. Mesonotum dark reddish brown. Scutellum and postscutellum yellowish brown. Abdomen dark brown, sparsely haired. Wings unusually broad and rather thickly clothed with fuscous hairs. Third vein unites with margin near apex, fifth at distal third, its branch at basal fourth; fork unusually long. Halteres fuscous yellowish. Legs dark brown. Claws long, moderately stout, pulvilli as long as claws. Genitalia: Basal clasp segment short, stout, and bidentate, with a distinct rudimentary tooth near the bottom of the excavation; dorsal plate divided, the lobes irregularly triangular, lobes of ventral plate rounded.

Type.—Cecid. a2880, New York State collection.

LUZON, Laguna Province, Mount Maquiling, September 23, 1917, College of Agriculture accession No. 18137 (*Uichanco*).

The one male described above was reared from a leaf gall on *Grewia stylocarpa* Warb. The species is remarkable in this genus because of the unusually broad wings, these having a length nearly one-half greater than the diameter. The specimen was badly broken and rumpled.

Contarinia saltata sp. nov.

Male.—Length, 1.25 millimeters. Antennæ one-fourth longer than body, thickly haired, reddish brown, of 14 segments, fifth having stems with a length equal to, and one-half greater than, their diameters, respectively. Basal enlargement subglobose, distal enlargement somewhat produced, both with moderately long circumfila; basal portion of terminal segment with the stem short, distal enlargement irregularly fusiform and tapering slightly to a very broad, broadly rounded apex. Length of first segment of palpi about two and one-half times its diameter; second a little longer, slenderer; third a little longer than second; fourth as long as third and somewhat dilated apicad. Mesonotum dark reddish brown. Scutellum reddish orange. Postscutellum dark brown. Abdomen reddish brown. Wings hyaline, moderately narrow, third vein uniting with margin at apex. Halteres yellowish basad, reddish apicad. Coxæ and legs mostly reddish brown. Claws long, slender, strongly curved apicad, pulvilli as long as claws. Genitalia: Basal clasp segment very short and stout; terminal clasp segment moderately long and stout, dorsal plate short, broad, narrowly incised, lobes obliquely truncate, lateral angles broadly rounded; ventral plate deeply and triangularly emarginate, lobes somewhat divergent and tapering to a narrowly rounded vertex; style moderately long, tapering strongly, narrowly rounded apicad.

Type.—Cecid. a2884, New York State collection.

LUZON, Laguna Province, Los Baños, February 6, 1918, College of Agriculture accession No. 18180 (*Uichanco*).

A series of specimens was taken from a spider's web on a leaf of *Andropogon sorghum* Linn. It is possible that this insect lives upon *Andropogon,* though it is very different from *Contarinia sorghicola* Coq., which is well known in America. It is described here because it is believed that the peculiar characters will make the recognition of this species easy and, therefore, no confusion need arise from a description not based in part upon a food-plant record.

Bremia macrofilum sp. nov.

Male.—Length, 1 millimeter. Antennæ one-half longer than body, thickly haired, dark brown, of 14 segments, fifth with stems having a length one and one-half and two and one-half times their diameters, respectively. Basal enlargement subglobose, distal enlargement oval, its length one and three-fourths times its diameter. Dorsal loops on basal circumfilum produced nearly to distal enlargement and dorsal loops of distal circumfilum extending to apex of basal enlargement of next segment. Terminal segment greatly produced, basal portion of stem with a length about five times its diameter, distal enlargement pyriform, its basal third rather strongly constricted. Appendage long, irregular, and slightly fusiform. First segment of palpi with a length about three times its diameter; second a little longer, stouter; third as long as second; fourth one-half longer than third and slenderer. Mesonotum dull dark brown. Scutellum yellowish brown. Postscutellum dark brown. Abdomen dark brown, almost black, sparsely haired; genitalia yellowish. Wings hyaline. Halteres yellowish basad, reddish apicad. Coxæ dark brown. Legs mostly reddish brown. Claws moderately long, slender, strongly curved, the anterior ones unidentate, pulvilli rudimentary. Genitalia: Basal clasp segment moderately long, stout; terminal clasp segment long, slender, swollen basad; dorsal plate deeply and triangularly emarginate, the lobe sparsely setose, tapering to a narrowly rounded apex; ventral plate apparently very long and slender and with a somewhat curved, quadrate, obliquely truncate, lateral process at the basal third, the length of which is approximately one-third that of the entire organ. The distal portion of the ventral plate beyond this process is slender and a little longer than the basal part; harpes chitinized, indistinct; style rather short, stout, obtuse apicad.

Female.—Length, 1.5 millimeters. Antennæ a little shorter than body, sparsely haired, dark brown, of 14 segments, fifth with a stem one-fourth the length of the cylindrical basal enlargement. The latter is two and one-half times as long as its diameter. It bears a sparse subbasal whorl of long, stout setæ and a median band of shorter, slender, curved setæ. Circumfila unusually heavy, terminal segment produced, length of basal portion four times its diameter, appendage knoblike. Mesonotum dark brown, submedian lines sparsely haired. Scutellum yellowish fuscous. Postscutellum dark brown. Abdomen mostly dark brown, basal segments with a dark orange hue. Legs mostly dark brown, fourth tarsal segment of anterior legs and distal tarsal segment of middle pair of legs white in certain lights. Ovipositor short, the lobes roundly triangular and sparsely setose, otherwise as in the male.

Type.—Cecid. a2888, New York State collection.

MINDANAO, Lanao District, Kolambugan, June 10, 1914, College of Agriculture accession No. 18184 (*C. S. Banks*).

The midges described above were accompanied by the statement that they were caught on a spider's web. They were dancing on the web, by the thousand, on a bright sunshiny afternoon. This peculiar species has unusually heavy circumfila in the female, and the male genitalia present striking characteristics.

Arthrocnodax copræ sp. nov.

Male.—Length, 0.75 millimeter. Antennæ a little longer than body, thickly haired, reddish brown, of 14 segments, fifth having stems with a length one-half and one and one-half times their diameters, respectively. Basal enlargement subglobose, distal broadly ovoid, both with moderately long and unusually heavy circumfila; basal enlargement of terminal segment subglobose, stem relatively short, distal enlargement broadly cylindrical, apex almost truncate. First segment of palpi short, irregular; second with a length three times its width; third a little shorter than second, more dilated; fourth one-half longer than second. Mesonotum shining dark brown. Scutellum and postscutellum dark reddish brown. Abdomen yellowish fuscous. Wings hyaline, third vein uniting with costa well before apex; fifth obsolescent distad, joining posterior margin at distal fourth, its branch at basal third. Halteres translucent whitish basad, fuscous apicad. Coxæ dark brown. Legs mostly yellowish brown. Claws rather long, evenly curved, slender, pulvilli rudimentary. Genitalia: Basal clasp segment moderately long, stout; terminal clasp segment rather long, swollen basad, dorsal plate deeply and triangularly emarginate, lobes triangular and sparsely setose; ventral plate moderately long, broad, broadly rounded apicad; style long, stout, and tapering to a narrowly rounded apex.

Female.—Length, 0.75 millimeter. Antennæ a little shorter than body, rather thickly haired, yellowish brown, of 14 segments, fifth with a stem about one-half the length of cylindrical basal enlargement, the latter about three times as long as its diameter. First segment of palpi short, irregular; second somewhat dilated, its length over twice its diameter; third one-half longer than second, slenderer; fourth a little longer than third and more dilated. Mesonotum dark reddish brown. Scutellum yellowish, darker basad. Postscutellum yellowish. Abdomen deep red. Halteres yellowish basad, fuscous apicad. Legs mostly yellowish fuscous, distal tarsal segments somewhat darker. Ovipositor short, lobes with a length two and one-half times width and sparsely setose.

Type.—Cecid. a2883, New York State collection.

The coloration in this species is evidently variable, another male having a shining reddish brown mesonotum, yellowish scutellum and postscutellum, and dark reddish abdomen. A second female had a shining, very dark brown, almost black mesonotum.

LUZON, Laguna Province, Los Baños, December 6, 1917, College of Agriculture accession No. 18173 (*C. S. Banks*).

A series of midges was reared from copra (dried coconut meat) kept in the laboratory for breeding *Necrobia rufipes* de Geer. The glass vessel had not been opened for a month. The characteristic short stems of the flagellate antennal segments and the heavy circumfila lead me to place this species here, though the poorly developed pulvilli would indicate an affinity with *Silvestrina* Kieff. or *Planodiplosis* Kieff., the latter known only by the female. It is probable that the larvæ are scavengers, as is the case with *A. aphiphila* Felt and some other American species.

Itonida paederiæ sp. nov.

Male.—Length, 1 millimeter. Antennæ probably twice the length of body, thickly haired, pale yellowish, probably with 14 segments, fifth having basal portion of stem with a length one-fourth greater than its diameter, distal portion three times as long as its diameter; basal enlargement subglobose, terminal enlargement subcylindrical, somewhat expanded distad and with a length one and three-fourths times its diameter, circumfila moderately long, terminal segment missing. First segment of palpi moderately long, irregular, length of second three times its diameter; third one-half longer and slenderer than second; fourth as long as third and somewhat dilated. Scutellum reddish brown. Postscutellum and abdomen mostly yellowish brown, abdomen thickly clothed with long hairs. Wings hyaline, membrane rather thickly haired, third vein uniting with costa just beyond apex, fifth obsolescent at the distal third, its branch at the basal third. Halteres translucent yellowish. Legs mostly dark straw. Claws moderately long, rather strongly curved, simple, pulvilli about three-fourths length of claws. Genitalia: Basal clasp segment rather long, slender; terminal clasp segment moderately long, stout and curved; dorsal plate moderately long, broad, deeply and triangularly emarginate, interior margin with a distinct setose process at basal third; lobes triangular and sparsely setose; ventral plate long, broad, deeply and roundly emarginate, lobes slender and setose apicad; style long, moderately stout and broadly rounded apicad.

Female.—Length, 1.5 millimeters. Antennæ probably nearly as long as body, rather thickly long haired, mostly reddish brown, of 14 (?) segments, fifth with a stem nearly three-fourths length of cylindrical basal enlargement. The latter is about three times as long as its diameter. First segment of palpi short, irregular; second narrowly ovoid, with a length three times its diameter; third one-half longer than second; fourth a little longer than third. Mesonotum yellowish brown, sparsely long haired. Scutellum brownish yellow. Postscutellum and abdomen reddish brown, the latter sparsely haired. Halteres yellowish basad, fuscous apicad. Coxæ yellowish brown. Legs mostly dark brown. Ovipositor short, terminal lobes sparsely setose, their length about three times their width. Ventral lobe much shorter and broadly rounded apicad.

Type.—Cecid. a2882, New York State collection.

LUZON, Laguna Province, Los Baños, October 13, 1917, College of Agriculture accession No. 18165 (*Uichanco*).

The specimens were reared from leaf galls on *Paederia tomentosa* Blume.

Cecidomyia philippinensis sp. nov.

Female.—Length, 2 millimeters. Antennæ about one-half the length of body, rather sparsely haired, reddish brown, of 14 segments, fifth with a stem one-fourth the length of the cylindrical basal enlargement, which latter is about three and one-half times as long as its diameter; a rather sparse whorl of stout setæ basad and a somewhat thick band of slenderer setæ subapicad; basal portion of terminal segment with a length about two and one-half times its diameter, the distal portion long and digitate. Each palpus consisting of one narrowly ovoid segment. Eyes holoptic. Mesonotum dull reddish brown, submedian lines yellowish, thickly haired. Scutellum pale yellowish. Postscutellum brownish yellow. Abdomen mostly dark red, thickly haired. Wings hyaline, slender, the length being nearly three times the width, subcosta united to costa by a rather distinct chitinized area and ending near basal third. Third vein nearly straight and joining margin well beyond apex of wing, fifth vein uniting with posterior margin at distal fourth, its branch near basal half. Halteres yellowish basad, reddish apicad. Coxæ pale yellowish. Femora distad reddish brown, tibiæ and tarsi mostly pale straw. Claws wanting. Ovipositor short, terminal lobes rather broadly ovoid and somewhat thickly setose.

Type.—Cecid. a2889, New York State collection.

LUZON, Laguna Province, Mount Maquiling, September 3, 1917, College of Agriculture accession No. 18316 (*Uichanco*).

The one female described above was accompanied by the following statement: "It is doubtful whether this is the cause of the numerous galls on the leaves of this plant (*Spatholobus philippinensis* Merr.), as this insect was bred out of a narrow thistle-shaped case, attached to the leaf and not from the galls." Despite the above, there is a fair probability that this is the gall producer; and, as there is a definite food-plant record, I have described the species from a somewhat mutilated specimen. Since the characters are sufficiently marked, there should be comparatively little difficulty in establishing the identity of the insect later.

THE PALMS OF THE PHILIPPINE ISLANDS

By O. Beccari

(*Florence, Italy*)

THREE PLATES

The species of palms at present known to be indigenous to the Philippines number one hundred twenty, not including a few semiwild or cultivated forms. Of that number but about a dozen are species of relatively wide geographic distribution, all the others being endemic forms. The nonendemic element is in part derived from species growing in swamps or at the mouths of rivers, along the coasts of neighboring countries, and are the following: *Oncosperma filamentosa, Oncosperma horrida, Caryota mitis, Licuala spinosa, Nipa fruticans, Korthalsia laciniosa,* and three species of *Calamus.* The following are also nonendemic Philippine palms: *Actinorhytis calapparia, Arenga saccharifera, Corypha elata, Metroxylon Rumphii, Caryota Rumphiana, Livistona cochinchinensis,* and *L. rotundifolia,* some of which may have been introduced by man or by other means. *Heterospatha elata,* which is common in the Philippines, is reported as growing also in the Moluccas, but I have not seen specimens of it collected in those islands. In fact the genus *Heterospatha* is represented in the Philippines by four species and may be considered as a Polynesian element in the Philippine flora. With this exception and that of *Adonidia,* discussed below, all the Philippine endemic species belong to genera more frequently found in the Malay Peninsula, the Malayan islands, and in Cochinchina; these genera are *Areca, Pinanga, Arenga, Caryota, Orania, Ptychoraphis, Oncosperma, Livistona, Korthalsia, Zalacca, Plectocomia, Calamus,* and *Daemonorops.*

Only one genus appears to be exclusively Philippine, *Adonidia,* mentioned above, which belongs in a group of palms very rich in genera and species in the Papuan and Polynesian regions, but only scantily represented in southern Asia and in Malaya proper.

It is rather surprising that some common Malayan genera are either not at all or at most very poorly represented in the Philippines. Thus the genus *Iguanura* is entirely wanting. In *Licuala,* a genus with numerous species in the primeval Malayan and Papuan forests as undergrowth palms, only the widespread and littoral *L. spinosa* has been found in the Philippines, where it occurs in the more southern islands of the Archipelago.

Other southern Asiatic or Malayan genera of which representatives are wanting in the Philippines are: *Pholidocarpus, Nenga, Cyrtostachys, Bentinckia, Gigliolia, Zalaccella, Calospatha, Pigafetta, Ceratolobus, Plectocomiopsis,* and *Myrialepis.* The genus *Eugeissonia* also, which is largely represented in Borneo, seems to be unrepresented in the Philippines.

Areca and *Pinanga,* among the Arecinaceae, and *Calamus* and *Daemonorops,* among the Lepidocaryeae, furnish two-thirds of the species of palms known as indigenous to the Philippines and form the great bulk of its palm flora.

The genus *Areca* is particularly remarkable, as out of the total number of thirty-six species known to me at present no less than ten are very characteristic Philippine ones. In this number is also included *Areca Catechu,* of which we have good grounds for believing that it may have acquired its actual specific characters in some part of the Philippines. Even leaving out of consideration the fact that a variety of *Areca Catechu* (var. *silvatica*) has been found growing as a real forest plant in Palawan, there occur in the Philippines other fine species of *Areca,* closely related to *A. Catechu,* although certainly specifically distinct from it. Of this number are *A. macrocarpa, A. parens, A. Whitfordii,* and perhaps *A. Camarinensis. Areca Catechu* var. *longicarpa,* which may perhaps represent a distinct species, is also, apparently, a wild-growing plant in Polillo. The group to which all the above-mentioned species belong has no representative elsewhere; and if we consider *A. Catechu* as a palm introduced into the Philippines, where can we look for the allied species, from which we may suppose it to have been derived? As is more fully shown in the detailed treatment of the genus *Areca,* several species besides those mentioned above are indigenous to the Philippines. It is plainly evident, therefore, that the genus *Areca* has found in the Philippines more favorable evolutionary conditions for the plasmation of its endemic forms than elsewhere, and especially for the species related to *Areca Catechu.*

In the genus *Pinanga* eighty species are now known to me (the descriptions of some of them not yet published), and 25 per cent of these are endemic Philippine species. However, this genus, unlike *Areca,* presents no conspicuous or anomalous Philippine representatives differentiating them much from the common Malayan types; but several are fine large palms deserving the name of trees; such as *Pinanga insignis, P. batananensis, P. sibuyanensis,* and *P. speciosa.* Among the small forms *P. maculata* alone shows close affinities with the Malayan *P. disticha.*

The genus *Orania* has also found in the Philippines very favorable conditions for evolution and is there represented by several forms, all of which, however, are apparently derived from two species belonging to two different and widely separated regions; namely, *O. macrocladus,* of the Malay Peninsula, and *Orania moluccana* and *O. regalis,* of the Moluccan and the Papuan regions.

In *Caryota* forms are found that are but slight modifications of Malayan species, and the same may be said of the genus *Arenga.* The variety *philippinensis* of *Caryota Rumphiana* may, perhaps, be considered as an endemic species of the second degree, but its great affinity with the other forms of that polymorphic palm, which is widely spread throughout the entire Malayan region, is plainly evident.

Arenga saccharifera is, I think, to be considered as an introduced and naturalized plant.

Oncosperma filamentosa, the elegant gregarious palm which so frequently gives so special a feature to the vegetation of the swampy estuaries in Borneo and Sumatra, is found in the Philippines only in Palawan. *Oncosperma horrida* is another Malayan type from which the two endemic species *O. platyphylla* and *O. gracilipes* have apparently been derived.

Livistona rotundifolia and *L. cochinchinensis,* two nonendemic species, are widely distributed in the Philippines,. and their presence in the Archipelago may be accounted for by the transport of their fruits from Indo-China, Celebes, and the Moluccas through the agency of birds or perhaps by that of flying foxes. *Livistona rotundifolia,* however, has given rise to some local forms in the Philippines. *Livistona Merrillii* and *L. Robinsoniana* are endemic.

The Philippine Lepidocaryeae number fifty-five, of which thirty-six belong to *Calamus,* thirteen to *Daemonorops,* three to *Korthalsia,* one to *Plectocomia,* and one to *Zalacca. Metroxylon Rumphii,* which seldom produces fertile fruits, is probably an introduced plant in Mindanao and other islands in the southern part of the Archipelago.

The Philippine species of *Calamus,* with only three exceptions, are endemic. The nonendemic species are *C. symphysipus,* a common plant in Celebes; and *C. ornatus* and *C. Diepenhorstii,* the last two rather common littoral Malayan species, although represented in the Philippines by distinct varieties.

The thirteen species of *Daemonorops* are also, with the exception of *D. Margaritae*, of southern China, all endemic, but several of them are closely related to species growing in neighboring countries. Thus *D. Gaudichaudii*, *D. affinis*, and *D. gracilis* are related to the common *D. hystrix; D. ochrolepis* approaches *D. Rumphii*, of the Moluccas; and *D. virescens* is allied to *D. longipes*, a common littoral Malayan species.

Korthalsia laciniosa is also a common littoral plant in southern Asia, but *K. scaphigeroides* and *K. Merrillii* are endemic, although related to Malayan species.

The only *Zalacca* known from the Philippines, *Z. Clemensiana*, belongs to the group which have the fruits covered with spiculiferous scales, as *Z. edulis* and allied species.

Plectocomia Merrillii is evidently a derivation from the Bornean *P. Muellerii.*

On the whole we are led to conclude that the Philippine palms have in great measure originated in the Archipelago, but their phylogeny may be traced to species growing chiefly in Borneo, Celebes, the Moluccas, and Indo-China, excluding about a dozen species, which possess adaptations for easy dissemination, and for this reason are palms of rather wide geographic distribution. In addition a Polynesian element is represented by *Adonidia* and *Heterospathe.*

The palm flora of the Philippines has, therefore, no individuality as to genera, the only genus peculiar to the Archipelago being the monotypic new genus *Adonidia.*

In the Philippines a few large genera have varied so much as to give origin to numerous species, quite different in that respect from what has happened in Polynesia, where monotypic or oligotypic genera are numerous, and where no genus occurs that contains a great number of species.

ENUMERATION OF THE PALMS INDIGENOUS TO, OR NATURALIZED IN, THE PHILIPPINE ISLANDS

Areca Catechu Linn. (var. *communis*).
Areca Catechu var. *silvatica* Becc.
Areca Catechu var. *batanensis* Becc.
Areca Catechu var. *longicarpa* Becc.
Areca macrocarpa Becc.
Areca Whitfordii Becc.
Areca Whitfordii var. *luzonensis* Becc.
Areca parens Becc.
Areca Ipot Becc.
Areca Ipot var. *polillensis* Becc.
Areca camarinensis Becc.
Areca Caliso Becc.
Areca costulata Becc.
Areca Vidaliana Becc.
Areca Hutchinsoniana Becc.
Pinanga maculata Porte.

Pinanga geonomaeformis Becc.
Pinanga modesta Becc.
Pinanga isabelensis Becc.
Pinanga heterophylla Becc.
Pinanga Barnesii Becc.
Pinanga Copelandi Becc.
Pinanga Curranii Becc.
Pinanga philippinensis Becc.
Pinanga Elmerii Becc.
Pinanga urdanetana Becc.
Pinanga samarana Becc.
Pinanga urosperma Becc.
Pinanga rigida Becc.
Pinanga Woodiana Becc.
Pinanga sclerophylla Becc.
Pinanga negrosensis Becc.
Pinanga insignis Becc. (forma *typica*).
Pinanga insignis var. *gasterocarpa* Becc.
Pinanga insignis var. *leptocarpa* Becc.
Pinanga insignis var. *Loheriana* Becc.
Pinanga batanensis Becc.
Pinanga basilanensis Becc.
Pinanga speciosa Becc.
Pinanga sibuyanensis Becc.
Actinorhytis calapparia Wendl. & Drude.
Heterospathe elata Scheff.
Heterospathe sibuyanensis Becc.
Heterospathe philippinensis Becc.
Heterospathe negrosensis Becc.
Ptychoraphis microcarpa Becc.
Ptychoraphis intermedia Becc.
Ptychoraphis Elmerii Becc.
Ptychoraphis cagayanensis Becc.
Adonidia Merrillii Becc.
Oncosperma filamentosa Blume.
Oncosperma horrida Scheff.
Oncosperma platyphylla Becc.
Oncosperma gracilipes Becc.
Orania philippinensis Scheff.
Orania philippinensis var. *sibuyanensis* Becc.
Orania paraguaensis Becc.
Orania decipiens Becc.
Orania decipiens var. *mindanaoensis* Becc.
Orania decipiens var. *montana* Becc.
Orania rubiginosa Becc.
Arenga saccharifera Labill.
Arenga mindorensis Becc.
Arenga tremula Blanco.
Arenga Ambong Becc.
Caryota Rumphiana var. *philippinensis* Becc.
Caryota Rumphiana var. *oxyodonta* Becc.
Caryota Cumingii Lodd.
Caryota Merrillii Becc.
Caryota majestica Linden.
Caryota mitis Lour.
Cocos nucifera Linn.
Nipa fruticans Wurmb.
Phoenix Hanceana Planch. var. *philippinensis* Becc.
Licuala spinosa Wurmb.
Livistona cochinchinensis Mart.
Livistona Merrillii Becc.
Livistona rotundifolia Mart.
Livistona rotundifolia var. *luzonensis* Becc.
Livistona rotundifolia var. *mindorensis* Becc.
Livistona Robinsoniana Becc.
Corypha elata Roxb.
Metroxylon Rumphii Mart.
Zalacca Clemensiana Becc.
Plectocomia Elmerii Becc.
Korthalsia scaphigeroides Becc.
Korthalsia Merrillii Becc.
Korthalsia laciniosa Mart.
Korthalsia squarrosa Becc.
Calamus mollis Blanco.
Calamus mollis var. *major* Becc.
Calamus mollis var. *palawanicus* Becc.
Calamus Meyerianus Schauer.
Calamus Blancoi Kunth.
Calamus melanorhynchus Becc.
Calamus filispadix Becc.
Calamus Diepenhorstii var. *exulans* Becc.
Calamus ornatus var. *philippinensis* Becc.
Calamus discolor Mart.
Calamus discolor var. *negrosensis* Becc.
Calamus Cumingianus Becc.
Calamus simphysipus Mart.
Calamus Merrillii Becc. (forma *typica*).

Calamus Merrillii var. *Nanga* Becc.
Calamus Merrillii var. *Merrittianus* Becc.
Calamus Foxworthyi Becc.
Calamus manillensis H. Wendl.
Calamus trispermus Becc.
Calamus Arugda Becc.
Calamus vinosus Becc.
Calamus Moseleyanus Becc.
Calamus Mindorensis Becc.
Calamus multinervis Becc.
Calamus grandifolius Becc.
Calamus Jenningsianus Becc.
Calamus Samian Becc.
Calamus megaphyllus Becc.
Calamus Elmerianus Becc.
Calamus mitis Becc.
Calamus Reyesianus Becc.
Calamus spinifolius Becc.
Calamus viridissimus Becc.
Calamus microsphaerion Becc.
Calamus microsphaerion var. *spinosior* Becc.
Calamus ramulosus Becc.
Calamus Vidalianus Becc.
Calamus siphonosphathus Mart.
Calamus siphonosphathus var. *sublaevis* Becc.
Calamus siphonosphathus var. *oligolepis major* Becc.
Calamus siphonosphathus var. *oligolepis minor* Becc.
Calamus siphonosphathus var. *polylepis* Becc.
Calamus siphonosphathus var. *batanensis* Becc.
Calamus dimorphacanthus Becc.
Calamus dimorphacanthus var. *montalbanicus* Becc.
Calamus dimorphacanthus var. *zambalensis* Becc.
Calamus microcarpus Becc.
Calamus microcarpus var. *diminutus* Becc.
Calamus halconensis Becc.
Calamus discolor Becc.
Daemonorops Margaritae var. *palawanicus* Becc.
Daemonorops virescens Becc.
Daemonorops ochrolepis Becc.
Daemonorops urdanetanus Becc.
Daemonorops pedicellaris Becc.
Daemonorops Loherianus Becc.
Daemonorops pannosus Becc.
Daemonorops oligolepis Becc.
Daemonorops Clemensianus Becc.
Daemonorops Gaudichaudii Becc.
Daemonorops affinis Becc.
Daemonorops Curranii Becc.
Daemonorops gracilis Becc.

NATURALIZED SPECIES

Areca Catechu Linn.
Actinorhytis Calapparia Wendl. & Drude.
Arenga saccharifera Labill.
Cocos nucifera Linn.
Metroxylon Rumphii Mart.

NONENDEMIC SPECIES

Heterospathe elata Scheff.
Oncosperma filamentosa Blume.
Oncosperma horrida Scheff.
Nipa fruticans Wurmb.
Licuala spinosa Wurmb.
Livistona cochinchinensis Mart.
Livistona rotundifolia Mart.
Korthalsia laciniosa Mart.
Calamus Diepenhorstii var. *exulans* Becc.
Calamus ornatus var. *philippinensis* Becc.
Calamus simphysipus Mart.
Daemonorops Margaritae var. *palawanicus* Becc.
Caryota mitis Lour.
Caryota rumphiana Mart.
Corypha elata Roxb.

ARECA Linnaeus

Ten species of *Areca* are at present known from the Philippines; all, with the exception of *A. Catechu*, are endemic. There are, moreover, several distinct varieties, for generally speaking the same species is rarely represented by individuals offering an absolute uniformity of characters, when inhabiting different islands, even when these are not separated by a wide extent of sea. There are some large species specially worthy of remark, for they are so much like *A. Catechu*, as to render it uncertain whether they are to be regarded, at times, as simply varieties of that palm or as distinct species; they are *A. macrocarpa*, *A. Whitfordii*, and *A. Catechu* var. *longicarpa*. The first two are really forest plants, and apparently also the last is a forest plant. *Areca Catechu* var. *silvatica* possibly represents the true wild plant of that widely cultivated species (of which the true place of origin has not been ascertained), for in the Philippines various forms of *Areca* occur so closely related to *A. Catechu* as to afford good ground for belief that it was in those Islands that *A. Catechu* finally assumed the specific characters it now exhibits. In support of this opinion I would observe that in no other part of southern and eastern Asia or Malaya is any species of *Areca* to be found which in any way approaches *A. Catechu* in specific characters, whereas in the Philippines an entire group of species exists closely related to it. *Areca parens* is another fine species, endemic in the Philippines, which, although endowed with characteristic and easily appreciable diagnostic characters, evidently belongs to the group of *A. Catechu*.

The fruits of *Areca Ipot* and *A. camarinensis* in their principal characters and general appearance are also very much like those of *A. Catechu*, but these two species belong to the group that produces female flowers, and then fruits, densely grouped around the main axis of the spadix, and are therefore related to the species for which was established the subgenus *Balanocarpus*, which includes *A. glandiformis*, of the Moluccas; *A. macrocalyx*, of the Papuan Islands, and a few others.

Areca costulata is no doubt related to *A.* (*Mischophloeus*) *paniculata* Scheff., a palm growing in northern Celebes and in the Moluccas; not only on account of its male flowers having the cyathiform calyx slightly 3-toothed and with a solid base, but also in its general habit. *Areca Caliso* is somewhat related to *A. costulata*, from which, however, it differs by the calyx of the male flower being divided into three small distinct sepals; its nearest allied species is probably *A. oxycarpa*, of Celebes. *Areca Vidaliana* and *A. Hutchinsoniana* are of the type of the very widespread *A. triandra*, not only on account of the male flowers being inserted in pairs on unilateral notches of the floriferous branches, but also because the male flowers have six stamens, but *A. triandra* has 3-androus flowers; on that account *A. Vidaliana* and *Hutchinsoniana* agree with *A. laosensis*, of Indo-China, which also, although of the general habit of *A. triandra*, has male flowers with six stamens.

Conspectus of the Philippine species.

a^1. Floriferous branches bearing only one or very few female flowers, sessile on their basal thickened part, and the geminate male flowers in distichous alternate indentures in their upper slender part.

b^1. Spadices spreadingly twice or thrice branched; palms with tall slender stems and relatively large fruits. (§ *Euareca.*)

c^1. Male flowers narrowly lanceolate (unknown in *A. Whitfordii*); rudimentary ovary conspicuous, trifid, as long as, or longer than, the stamens; anthers acute or acuminate. Female flowers with broadly imbricate sepals about as broad and long as the petals. Fruit with the pericarp finally entirely disintegrating into very fine and soft fibers.

d^1. Fruit having the mesocarp considerably thicker at both ends than at the sides, and the seed inserted considerably above the base.

e^1. Seed having the vascular bundles of the integument arching on the sides, and strongly anastomosing immediately from its base, even on the raphal side............................1. *A. Catechu.*

f^1. Fruit orange-red; globose-ovoid or ovoid-ellipsoid, not more than one-third or one-fourth longer than broad (4 to 5 cm long, 3 to 4 cm broad). Seed subglobose with a more or less flattish base................*A. Catechu* (forma *communis.*)

f^2. Fruit ovoid-ellipsoid, rather ventricose, smaller than usual (4 cm long and 3 cm or a little less broad); seed globose-depressed or broader than high, the base flat.
A. Catechu var. *silvatica.*

f^3. Stems thicker and shorter than in forma *communis;* spadix denser and with shorter floriferous branches.
A. Catechu var. *batanensis.*

f^4. Fruit narrowly ellipsoid; twice, and even more, as long as broad (5.5 to 7 cm long, 2.5 cm broad). Seed ovoid-conical with a blunt apex and flat base, slightly longer than broad.
A. Catechu var. *longicarpa.*

e^2. Seed having the vascular bundles of the integument arising straight, almost erect, from the raphal side and slightly branching. Fruit elongate-ellipsoid, twice as long as broad (7 cm long, 3.2 to 3.5 cm broad). Seed ovoid-conical with a blunt apex...2. *A. macrocarpa.*

d^2. Fruit ellipsoid-fusiform, twice and more as long as broad, having the mesocarp not much thicker at the ends than at the sides. Seed placed nearly in the middle of the pericarp and equally narrowing to both ends.

e^1. Fruit 4 to 4.5 cm long, 1 to 2 cm broad............3. *A. Whitfordii.*

e^2. Fruit larger, 5.5 cm long, 2 cm broad.
A. Whitfordii var. *luzonensis.*

c^2. Male flowers relatively large, ovoid-subtrigonous or trapezoidal; rudimentary ovary small, slender, entire, subulate, shorter than the stamens; anthers very obtuse. Sepals of the female flower considerably smaller than the petals. Fruit large, ovoid, about 6 cm long, 3.5 cm broad, the pericarp fibrous in its outer half, woody in the inner half. Seed broadly ovoid, its vascular bundles very numerous, parallel and almost undivided, ascending from the raphal side..4. *A. parens.*

b^2. Spadices simply branched. Female flowers clustered around the main axis, solitary, sessile or nearly so, at the base of the branchlets; the latter slender and bearing alternately distichous male flowers. (§ *Balanocarpus.*) (Of *A. camarinensis* the detached fruits only are known, and it is doubtfully placed here.)

c^1. A palm with the habit of *Areca Catechu* but smaller (stem about 4 m high, 7 to 12 cm in diameter); fruiting spadix dense, cylindraceous-oblong, about 14 cm long, 6 to 7 cm thick. Fruit ovoid, very similar to that of *A. Catechu,* 5 cm long, 3 cm broad. Seed globose with rounded (not flat) base and with the vascular bundles of the integument very close together, much anastomosing and forming very narrow loopholes all around the seed. 5. *A. Ipot.*

d^1. A smaller plant, the stem 5 cm in diameter, the spadix smaller, with fewer female flowers, and forming a shorter mass. *A. Ipot* var. *polillensis.*

c^2. Fruit ovoid, 4 to 5 cm long, 3 cm broad. Seed conical-ovoid; the vascular bundles of the integument forming a uniform network all around the seed with lozenge-shaped loopholes. Otherwise the fruit is similar to that of *A. Catechu*........6. *A. camarinensis.*

a^3. Floriferous branches bearing several female flowers on their basal parts, gradually narrowing above and bearing male flowers only in pairs on alternating notches. Low palms with relatively small or medium-sized fruits. (§ *Arecella.*)

b^1. Spadix simply branched, with thickish floriferous branches appressed to the main axis, and bearing in their basal part numerous, approximate, alternate, female flowers. Male flowers hexandrous, the calyx with three small, distinct sepals; anthers acute. Fruiting perianth cupular, truncate, the petals exactly equaling the sepals. Fruit ellipsoid, 3 to 3.5 cm long, 20 to 22 mm thick, the pericarp entirely dissolving into very fine, soft fibers................7. *A. Caliso.*

b^2. Spadix twice loosely branched; floriferous branches slender, bearing in their basal part three or four alternate, rather distant, female flowers, and in the upper and slenderer part alternate male flowers. Calyx of the male flowers subpedicelliform, shortly 3-dentate with a solid base; anthers bifid at the apex. Fruit small, pluricostulate, ellipsoid, the pericarp formed by only two layers of rigid complanate fibers.. 8. *A. costulata.*

a^4. Spadix diffusely, two or three times branched, the floriferous branches bearing one or more female flowers in their lower part, and above male flowers in pairs in unilateral notches. Low slender palms having very small male flowers, with the calyx completely divided into three sepals. Fruit small. (§ *Arecopsis.*)

b^1. Male flowers 2.5 to 3 mm long; stamens 6; rudimentary ovary as long as the stamens, divided into three points. Female flowers ovate, obtuse, 8 mm long, 4.5 to 5 mm broad. Fruit small, oblong-ellipsoid or subfusiform, 17 to 19 mm long and broad; pericarp rather thin, the mesocarp formed by only two layers of slender, but rigid, flattened, parallel fibers............................9. *A. Vidaliana.*

b'. Male flowers smaller than in *A. Vidaliana* (2 mm or a little longer); stamens 6; rudimentary ovary as long as the stamens, trifid. Female flowers ovoid, conical, narrowing to an acute point, larger than in *A. Vidaliana*, 13 to 14 mm long, 7 mm broad at the base. Fruit also larger, ellipsoid-elongate or subfusiform, about 3 cm long, 9 mm broad..10. *A. Hutchinsoniana.*

1. **ARECA CATECHU** Linn. (forma **COMMUNIS**).

Commonly cultivated throughout the Archipelago and occasionally spontaneous. The specimens collected in Mindanao on the edge of the forest at Katajan, Mount Malindang, Misamis Province, *For. Bur. 4717 Mearns & Hutchinson* were probably from a semiwild plant.

ARECA CATECHU Linn. var. **BATANENSIS** Becc.

Areca Catechu (non Linn.) Becc. in Philip. Journ. Sci. **3** (1908) Bot. 340.

BATAN ISLANDS, Batan, Santo Domingo de Basco, *Bur. Sci. 3834 Fénix*, along a mountain stream.

According to the collector this is 7 to 8 m high with a trunk 25 cm in diameter. It is therefore a plant with a relatively shorter but thicker trunk than the common *Areca Catechu.* The spadix is also denser than in that palm and with shorter floriferous branchlets, the latter only 10 to 12 cm in length. I have not seen the fruits of this apparently very local variety.

ARECA CATECHU Linn. var. **SILVATICA** Becc.

Trunk 10 to 12 m high, 10 to 15 cm in diameter. Leaves 2 to 2.5 m long with about 30 pairs of leaflets. Spadix diffuse, with very elongate and slender floriferous branchlets. Male flowers 4 mm long, in shape exactly as in the type, with 6 stamens and the rudimentary ovary divided into 3 acuminate points. Female flowers relatively narrow, tapering above to a conical and rather acute point, 12 to 14 mm long, 7 mm thick. Fruit reddish-yellow, ovoid-ellipsoid, broadly conical in the upper part, 4 cm long (including the perianth), 28 mm thick. Seed (placed almost in the center of the fruit) globular-depressed or slightly broader than high (16 mm high, 22 mm broad), regularly rounded above and flattish in its basal part; embryo conical; rumination and network of the surface of the integument exactly as in the type; walls of the pericarp 3 mm thick at the sides (in the dry fruit). Fruiting perianth 2 cm broad at the mouth.

PALAWAN, near Lake Manguao, in a narrow valley along a small stream in the primeval forest, *Merrill 9447*, April, 1913.

This differs from the common form in having smaller fruits with the seed globular-depressed and in its more acuminate female flowers.

As to the possibility of this being a really wild form of *Areca Catechu*, Mr. Merrill writes to me from Manila under date of October 2, 1914, as follows:

> As to *Areca Catechu* the specimen that I collected in Palawan is the only one that I have seen growing in primeval forests in all my travels in the Philippines. At the place where found the plants, few in number, were growing in a forested ravine along a small stream at a place where an old and apparently much traveled native trail crossed the stream.
>
> I strongly suspect that the trees that I found in this place originated from seeds accidentally left there by natives. The species is of course very common and very widely distributed in the Philippines, but normally is found only in the settled areas and in cultivation. It is, however, distinctly self seeded and one frequently finds young plants in thickets, fence rows, etc., that have not been purposely planted, but which have originated from seeds fallen from neighboring trees.

ARECA CATECHU Linn. var. **LONGICARPA** Becc. in Philip. Journ. Sci. 6 (1911) Bot. 229.

POLILLO, *Bur. Sci. 10470 McGregor*, October–November, 1909. It is not known whether or not the specimens were collected from cultivated or wild plants.

This is a very remarkable variety on account of its elongate-ellipsoid fruit, almost equally tapering at both ends, and with a conical apex, varying from 5.5 to 7 cm in length (including the perianth) and from 2.5 to 3 cm in diameter, or more than twice as long as broad. The pericarp is 3 to 4 mm thick at the sides, and is solid in most of its lower half, the seed being inserted very high, or only a little less than half the entire length of the pericarp. The mesocarp is not so filled with fibers as in the other forms of *Areca Catechu*, and in its central and basal part the fibers extend through a very soft and spongy tissue. The seed is 24 mm long (in one specimen), has a nearly or quite flat (22 mm broad) base, and suddenly assumes a conical shape, yet it is blunt at the apex; the vascular branches of the integument start from the raphe at an angle of about 45° and form a close network as in the typical form. The male flowers are 6 mm long and 1.5 mm broad, or somewhat longer, narrower, and more acuminate than in forma *communis*. The fruits are said to be yellow.

It seems to represent rather a subspecies of *Areca Catechu* than a simple variety of that plant.

2. **ARECA MACROCARPA** Becc. in Philip. Journ. Sci. 4 (1909) Bot. 601.

MINDANAO, Zamboanga District, Port Banga, *For. Bur. 9103 Whitford & Hutchinson*, January, 1908.

This seems to be a close ally of *Areca Catechu*, but unfortunately its male flowers are not known for a precise comparison with the latter. Its fruit, however, is considerably larger than that of *A. Catechu*, from which it is further distinguishable by its being equally tapering at both ends, twice as long as broad; by the seed inserted very high, or somewhat above the lower third of the entire fruit; by the ovoid-conical seed with flat base; and by the vascular branches of the integument ascending in great numbers from the raphe and arching on the sides at an angle of 45°, forming there a rather close network. In the only seed I dissected, the embryo was globular-depressed, whereas it is conical in *A. Catechu* and all its varieties. The fruiting perianth is distinctly campanulate.

3. **ARECA WHITFORDII** Becc. in Philip. Journ. Sci. 2 (1907) Bot. 219.

MINDORO, in the semiswampy forests called "guipa" by the natives, near sea level, Bongabon River, *Whitford 1372*, Tagalog, *bungan gubat.*

I formerly supposed that *Areca Whitfordii* was related to the species having male flowers with three stamens; but now that I am in possession of additional material, although even now incomplete, it appears to me that its real affinities are with *A. Catechu* and especially with the variety *longicarpa*, because the floriferous branchlets of *A. Whitfordii* bear, as does *A. Catechu*, alternate and not unilaterally geminate male flowers as is the case in *A. triandra* and allied species; although the male flowers of typical *A. Whitfordii* are as yet unknown. It differs, however, from *A. Catechu* var. *longicarpa* especially in its ovoid-ellipsoid seed, narrowed at both ends, symmetrically placed in the central part of the fruit, of which it occupies almost the entire length, the pericarp extending below and above the seed only 7 mm.

ARECA WHITFORDII Becc. var. **LUZONENSIS** Becc. var. nov.

This differs from the type only in its larger fruits. The fruits seen by me, not thoroughly mature but apparently having attained their definitive dimensions, are ellipsoid-fusiform, 5.5 cm long, equally narrowed at both ends, and 2 cm in diameter in their central part. The seed, from the size and the shape of the endocarpal cavity, is apparently equally narrowed at both ends, 28 mm long and 16 to 17 mm through at its middle; the portion of solid pericarp remaining above and below the seeds is 1 cm in length. The leaves have 20 to 25 pairs of leaflets.

LUZON, Nueva Vizcaya Province, vicinity of Dupax, *Bur. Sci. 11384 McGregor*. The collector notes that it is a really wild, and not a cultivated, plant and that its fruits are used as a substitute for those of *A. Catechu*. Not differing from the above is *For. Bur. 17770 Curran* from Cagayan Province, Luzon, where it is common in overflowed river swamps.

4. **ARECA PARENS** Becc. sp. nov.

Major, *A. Catechu* similis. Frondium segmenta majuscula conspicue bicostulata, falcato-acuminata. Spadix duplicato-ramosus, ramis floriferis in parte basilari crassiusculis, superne zigzag sinuosis. Flores ♂ pro rata majusculi, ovato-subtrigoni vel trapezoidei, 7 mm longi, 4 mm lati; calyce minuto, sepalis triangularibus, acuminatis; staminum filamentis brevibus; antheris linearibus, obtusis; ovarii rudimento parvo subulato. Flores ♀ ovati, 12 ad 15 mm longi, sepalis quam petala conspicue brevioribus. Fructus ovato-ellipticus, inter majores, 6 et ultra cm longus, 3.5 cm crassus, utrinque aequaliter attenuatus; pericarpio ad latera 5 ad 6 mm spisso, in dimidia inferiori parte lignoso, caetero fibris tenuibus percurso. Semen prope tertiam inferiorem partem insertum, ovoideo-conicum, 28 mm longum, 22 mm crassum, integmenti ramificationibus vascularibus numerosis, parallelis, indivisis, a raphe adscendentibus, superne et in facie antirapheali tantum anastomosantibus. Albumen lamellis rectis numerosis descentibus ruminatum.

Apparently of the general habit and dimensions of *Areca Catechu* and with the same kind of leaves. One of the leaflets is about 1 m long and 8 cm broad, very strongly bicostulate and with an acuminate falcate point. The spadix has the same kind of branching as that of *Areca Catechu;* its ultimate divisions or floriferous branches are 15 to 20 cm long, 3 mm thick at their bases, angular, strongly zigzag-sinuous with only one female flower in their basal part but covered elsewhere with distinctly distichously alternate male flowers; the latter are in pairs at every flexure and furnished with two very small triangular bracteoles; they are asymmetrical, irregularly ovoid-subtrigonous or trapezoidal by mutual pressure, and relatively broad (7 mm long, 4 mm broad); the calyx has three, very small, triangular-acuminate, dorsally keeled sepals; petals pergamentaceous, rather rigid, ovate, bluntish; stamens 6, the filaments terete, short; anthers linear, more or less sinuous, bluntish, with parallel cells, and dark connective; rudimentary ovary very small, subulate, scarcely as long as the filaments. Female flowers sessile on a horizontal cushion, the latter furnished with a small rim representing the floral bract; they are ovate, obtuse, 12 to 15 mm long, 10 mm broad; sepals broadly triangular, acute or acuminate, considerably smaller than the petals; the latter, one-third or more longer than the sepals, very broadly obtuse or else cucullate at the apex. Fruit regularly ovoid-ellipsoid, equally narrowed at both ends, 63 mm long and 35 mm through (in two specimens) or a little less than twice as long as broad. The pericarp is 5 to 6 mm thick at the sides, and only in its outermost half at maturity does it disintegrate into capillary fibers, its inner half remaining woody; the apex in its internal part is also woody, but the base is entirely fibrous. The seed is inserted a little below the lower third of the entire fruit, ovoid with a flattish base and a very obtuse apex, 28 mm long, 22 mm broad; the vascular branches of the integument are very numerous and arise parallel and undivided at an acute angle from the base, anastomosing only above and on the ventral or antiraphal side; the rumination of the albumen is produced by numerous straight and descending lamellæ. Embryo broadly ovoid.

LUZON, Camarines Province, *For. Bur. 21712 Peñas, Soriano, & Abellanosa*, April 23, 1914, with the Bicol name *tacohtoh*.

This is a wild-growing species approaching *Areca Catechu*, although doubtless specifically distinct from it. The spadix, in flower, has the appearance of that of *A. Catechu*, but its floriferous branches are more robust and strongly zigzag-sinuous in the male flower-bearing portion. The male flowers are larger and broader than those of *Areca Catechu* and differ also in having very blunt anthers and a short rudimentary ovary. Furthermore, the female flowers of *A. parens* differ also from those of *A. Catechu* especially in the sepals being considerably shorter than the petals, the latter being usually blunt and more or less cucullate at apex. The fruit of *Areca parens* resembles that of *A. macrocarpa*, but differs from the fruit of all the species approaching *A. Catechu* in having the outer half of the pericarp disintegrable into soft fibers only, the inner half being woody. The seed is also characterized by the very numerous vascular branches of the integument lying close together, parallel and undivided laterally and on the raphal side, and by the lamellæ which cause the rumination of the albumen being straight and inclined toward the base of the seed.

5. **ARECA IPOT** Becc. in Leafl. Philip. Bot. 2 (1909) 639.

Areca Catechu Linn. var. *humilis* Blanco, Fl. Filip. (1837) 716, ed. 2 (1845) 495, ed. 3, 3 (1879) 120.

LUZON, Tayabas Province, Sampaloc, *For. Bur. 10178 Curran* (cultivated specimen); Lucban, *Elmer 9292*, local name *bunga ipot*.

This is chiefly distinguishable by its simply branched spadix having all the female flowers crowded around the main axis and by the male flowers being geminate or solitary in alternate notches of the slender branchlets, each of which starts from the base of a female flower. The ovoid fruit closely resembles that of *Areca Catechu* and the seed also is similar, but in *A. Ipot* the vascular ramifications of the integument of the seed are more numerous, more anastomosing, and form a closer network than in *A. Catechu,* and the rumination of the albumen is formed by more numerous and straighter lamellae, all converging toward the center of the seed. The pericarp entirely disintegrates into soft capillary fibers, except in the innermost part for the extent of about a millimeter.

ARECA IPOT Becc. var. **POLILLENSIS** Becc. in Philip. Journ. Sci. 6 (1911) Bot. 229.

POLILLO, *Bur. Sci. 10463, 10469 McGregor, Bur. Sci. 6938 Robinson,* along streams at about 25 meters' elevation (apparently a wild plant).

This differs from the type in being a smaller plant, with a stem about 4 m high and 4 to 5 cm in diameter, and in having a shorter spadix.

6. **ARECA CAMARINENSIS** Becc. sp. nov.

Gracilis, caudice circiter 3 cm diametro, internodis longiusculis (7 cm longis in specimene suppetenti). Frondium (circiter 2 m longum) segmenta numerosa, utrinque 8 ad 10, aequidistantia, alterna vel subopposita, 4 ad 6 cm inter se dissita, angusta, elongata, falcato-sigmoidea, 2- vel 3-costulata, costulis conspicuis, complanatis, 2 mm elevatis; segmentis inferioribus et intermediis acuminatissimis, majoribus 60 ad 75 cm longis, 2.5 ad 5 cm latis, nonnullis superioribus apice attenuatis et falcatis, attamen inciso-dentatis, duobus terminalibus 6- vel 7-costulatis, brevioribus, circiter 30 cm longis, 4 ad 5 cm latis, apice truncatis et duplicato-inciso-dentatis, dentibus brevibus. Petiolus longiusculus, subteres. Rachis compressa, in parte basilari subtus rotundata, apicem versus compressa et subtus plana, superne angulo elevato acuto percursa, marginibus acutis. Spadix * * *. Fructus rubri, ovati, 4 ad 5 cm longi, 3 cm crassi, utrinque rotundati, areola stigmatiferia plana, minime elevata, coronati; mesocarpio crasso, fibris tenuibus numerosissimis percurso; endocarpio tenuiter lignoso, intus albescenti et laevi; semine conoideo, 2 cm longo, 15 mm diametro, apice obtuso, basi truncato, distincte reticulato, lamellis approximatis rectis, descendentibus ruminato.

LUZON, Camarines Province, Goa, on the lower slopes of Mount Isarog, *For. Bur. 14268 Aguilar*, April, 1909, Bicol *mono*.

I have seen one leaf and one fruit only. It seems, however, to be a very peculiar and interesting palm, apparently belonging to the section *Balanocarpus*, although its true affinities remain somewhat uncertain; neither the entire spadix nor the male flowers are known. The fruit somewhat resembles that of *Areca Catechu* and of *A. Ipot*, but it differs from both by the vascular bundles of the integument which form a distinct and rather regular network with 1.25 mm wide lozenge-shaped loopholes. From *A. Catechu* the fruit also differs in the numerous and approximate lamellae of the rumination which converge toward the center in a straight and descending course.

7. ARECA CALISO Becc. in Leafl. Philip. Bot. MS.

MINDANAO, Davao District, Mount Apo, Todaya, at about 1,000 meters' elevation, *Elmer 11898*, September, 1909, locally known as *caliso:* Agusan Subprovince, Mount Urdaneta, along the Dalahcan River, *Elmer 13814*. BILIRAN, *Bur. Sci. 18875 McGregor*. LEYTE, Dagami, *Bur. Sci. 15388 Ramos*, August, 1912; in this specimen the fruit is a little larger than in the Mindanao plant.

8. ARECA COSTULATA Becc. sp. nov.

Mediocris, caudice circiter 5 m longo. Folia inaequaliter pinnatisecta, segmentis rigide papyraceis, 2-3-costulatis, falcatis, vel in apice duplicato-bifidis, majoribus 60 cm longis, 7 cm latis. Spadix patule laxeque ramosus; ramulis floriferis in parte basilari, flores 2 ad 4 remote alterne ferentibus, superne zigzag-sinuosis et floribus masculis geminis alterne onustis. Flores masculi majusculi, 6 ad 8 mm longi; calyce campanulato, basi plaeno, breviter 3-dentato; staminibus 6; antheris apice profunde bipartitis; ovarii rudimento inconspicuo papillaeformi. Fructus ovoideo-elliptici, 3 cm longi, 13 mm crassi, conspicue longitudinaliter pluricostulati; pericarpio coriaceo, 2 mm spisso, fibris rigidis biseriatis percurso. Perianthium fructiferum campanulatum, non marcescens.

Apparently of medium or rather small size. Stem (slender?) 5 m high. The leaves have very unequal and inequidistant, firmly papyraceous leaflets, the latter with very robust main nerves (costae) and sharp secondary nerves, which render both surfaces distinctly striate; all nerves are sprinkled, especially on the lower surface, with very minute glanduliform papillae. The lower leaflets in the specimen before me are 3-costulate, 60 cm long, 7 cm broad, base broad, apex falcate; upper leaflets smaller, 2- to 3-costulate, double-toothed at the apex, the primary teeth 4 to 6 cm long, the secondary teeth short, acute; uppermost leaflets narrow, straight, their secondary teeth short, acute. Spadix loosely twice branched; primary branches 20 to 30 cm long, bearing few, gradually diminishing, floriferous branchlets; the latter have a naked basal part 3 to 4 cm in length, then bear three or four alternate female flowers and above them the male flowers, which are alternately inserted in pairs at every indenture on the rather elongate, filiform, zigzag-sinuous upper part of the branchlets. Female flowers ovoid, coriaceous, 8 to 10 mm long; corolla very slightly longer than the calyx, the petals surpassing the sepals solely by their small, apical, valvate, 1.5 mm long, triangular, bluntish apices; floral bracts small. Male flowers lanceolate, acute or acuminate, 6 to 8 mm long; calyx campanulate, shortly and broadly 3-toothed, solid in its lower part and flat at the base; corolla about four times as long as the calyx; petals pergamentaceous, lanceolate-acuminate; stamens 6, very slightly shorter than the petals; filaments terete, unequal, some of them at times as long as their respective anthers, the latter linear, slightly sinuous, deeply bipartite at apex and with the cells deeply separated at the base; rudimentary ovary inconspicuous, papillaeform. Fruits ovoid-ellipsoid, slightly ventricose in the middle, equally tapering to both ends, 3 cm long, 13 mm broad, boldly longitudinally striate or pluricostulate (when dry), terminated by a circular areola 3 mm in diameter bearing the remains of the stigmas. Pericarp coriaceous, not quite 2 mm thick, formed by two layers of relatively very robust and hard fibers (the cause of the ribs on the dry fruit). Seeds ovoid-oblong, rounded above, deeply ruminated. Fruiting perianth campanulate, not accrescent, the apices of the sepals and petals unchanged (not marcescent).

LEYTE, Dagami, *Bur. Sci. 15236 Ramos*, August, 1912, in forests.

So far as I can judge from the very fragmentary specimens at my disposal, this seems to be a plant of modest dimensions. It is especially characterized by its relatively firm leaflets, which are very minutely papillose-punctulate on the nerves, especially on the lower surface; by its diffusely branched spadix; by the relatively large male flowers, having a subpedicelliform, campanulate, shortly 3-toothed calyx, solid in its lower part; by the stamens with relatively long filaments and anthers, which are linear and deeply incised at their apices; by the inconspicuous rudimentary ovary; by the floriferous branches bearing few distant flowers in their basal part and alternate pairs of male flowers in their zigzag-sinuous upper parts; by the campanulate fruiting perianth unchanged; and by the small, ellipsoid, pluricostulate fruits, having in the pericarp a double series only of very rigid robust fibers.

9. **ARECA VIDALIANA** Becc. in Philip. Journ. Sci. 2 (1907) Bot. 222.
Areca mammillata Becc. op. cit. 220.

PALAWAN, *Vidal 3955* in Herb. Becc. *Areca mammillata* Becc. was also collected in Palawan, *For. Bur. 3816 Curran*, 1906, in swampy places along the Sariban River; Taytay, *Merrill, Phil. Pl. 1464*, May, 1913.

I previously considered the plant collected by *Curran* in Palawan and named by me *Areca mammillata* to be a species distinct from *A. Vidaliana*, because the specimens at that time at my disposal presented some remarkable differences in the leaves, the segments being 3- or 4-costulate in *A. Vidaliana* and 1-costulate in *A. mammillata;* but after the inspection of more complete material I have found that in *A. Vidaliana* the character derived from the number of main costae in the leaflets is a very variable one, and that the flowers and fruit offer no differences in the two plants. *Areca Vidaliana* is very similar in habit to *A. triandra*, but its male flowers are always 6-androus, and not 3-androus as is the case in the latter.

10. **ARECA HUTCHINSONIANA** Becc. nom. nov.
Areca mammillata Becc. var. *mindanaoensis* Becc. in Philip. Journ. Sci. 4 (1909) Bot. 602.

A slender palm. Stem about 3 cm in diameter. Leaves about 1 m in length. Leaflets numerous, subequidistant, 4 to 6 cm apart on each side of the rachis, usually bicostulate, but at times 1- to 4-costulate, falcate-sigmoid, slightly attenuate at the base, and gradually narrowed upward to a long, linear, caudate tip, when unicostate, 2 cm, when bicostulate, 4 to 4.5 cm broad; the 3- or 4-costulate leaflets are, of course, proportionally larger; the two of the apex are united by their bases, truncate and almost praemorse, and with as many incisions as there are costae; the resulting primary teeth are shallowly and obtusely 2-toothed. Spadix broadly panicled, twice branched, its pedicellar part very short and flattened, 10 to 15 mm long; the main branches, after the fall of the male flowers, are spreading and devaricate; the lowest branches are the largest, 15 to 20 cm long or more, and are unilaterally divided into several small secondary or floriferous branchlets, each of which carries in its basal part one or two sessile female flowers, and is very slenderly filiform in its upper part; this part is unilaterally and very closely notched, and carries two male flowers at each notch. The male flowers are very small, 2 mm or slightly longer, lanceolate, acute or bluntish; the calyx is very small, trigonous, and almost entirely divided into three acuminate sepals; the corolla is about four times as long as the calyx; stamens 6, slightly shorter than the petals; anthers linear-lanceolate, acute-apiculate; rudimentary ovary represented by three filiform bodies as long as the stamens. Female flowers ovoid, obsoletely angular, rounded or flattish at the base, gradually attenuate above, acute, 13 to 14 mm long, 7 mm broad at the base; sepals broadly ovate, minutely ciliate, obsoletely keeled and slightly thickened below the bluntish or only slightly acute apices; petals imbricate, broadened at both sides in their basal part, and suddenly contracted into a thick, triangular, acute, valvate apex, the latter, 3 to 4 mm long, protruding entirely above the calyx; ovary oblong, attenuate below; stigmas 3-gonous, spreading. Fruit very narrowly ellipsoid-oblong or subfusiform, diminishing considerably toward both ends, about 3 cm long, 9 mm in diameter. Pericarp thin, formed by only 2 or 3 layers of slender, parallel, complanate fibers, which render the surface of the dry fruit very finely striate longitudinally. Seed 13 mm long, 6.5 mm thick. Fruiting perianth cyathiform, 12 mm high.

MINDANAO, Zamboanga District, Port Banga, in forests at about 20 meters above sea level, *For. Bur. 9141 Whitford & Hutchinson* (specimen with fruits). BASILAN, near the southwest end of Mindanao, Mount Balanting, at about 100 meters above sea level, *For. Bur. 4019 Hutchinson*, February, 1906, a palm 3 meters high, flowers white, fruit white; very common, local name *pisa*.

Apparently also referable to *A. Hutchinsoniana* is *Vidal 4065* (in Herb. Beccari), from Siassi, one of the smaller islands in the Sulu Archipelago, southwest of Basilan.

The description above, as regards the fruit, is derived from *Whitford & Hutchinson 9141*, otherwise from *Hutchinson 4019*. It is closely related to *Areca Vidaliana*, from which it differs in its smaller male and larger female flowers and, especially, in its larger fruits.

PINANGA Blume

Conspectus of the species.

a^1. Very slender plants having simple flabellate leaves or only one or two segments on each side of the rachis.
  b^1. Leaves mottled (at least those of young plants), deeply bilobed, otherwise entire.......... 1. *P. maculata.*
  b^2. Leaves with a terminal, deeply bilobed flabellum and 1 or 2 acinaciform segments on each side of the rachis. Spadix simple. Fruit distichous.......... 2. *P. geonomaeformis.*
a^2. Leaves having few (4 to 9), very unequal, inequidistant segments on each side of the rachis. Spadix branched. Small plants with slender stems 1 to 3 cm in diameter.
  b^1. Fruits biseriate.

c^1. Leaves short with very few (4 or 5), unequal, sigmoid-acinaciform, 3- to 7-costulate segments on each side of the rachis, ashy-puberulous underneath, at least in newly expanded leaves. Spadix with 3 or 4 branches only. Fruits exactly distichous, narrowly ovoid, with a conical point, 15 to 16 by 6 to 7 mm. Seed caudiculate at the base; vascular branches of the integument rather numerous, nearly simple.. 3. *P. modesta.*

c^2. Leaves having on each side of the rachis 8 or 9, narrow, 2- to 4-costulate, distant, ensiform-subfalcate, very acuminate segments, which are glabrous underneath. Spadix with 5 or 6 branches. Fruits exactly distichous, narrow, conical-subfusiform, broadest below their middle, 16 to 18 by 6 mm; seed elongate, conical in its upper part; vascular branches of the integument very few (3 or 4), almost simple.. 4. *P. isabelensis.*

b^2. Fruits 3-seriate. Leaves having on each side of the rachis 7 or 8 very inequidistant, unequal, 1- to 4-costulate, narrowly falcate-sigmoid, long-acuminate segments, which are glabrous underneath. Spadix with few (5) triquetrous branches. Fruit small, 11 to 12 by 5 to 5.5 mm, narrowly ovoid-ellipsoid, acute, equally narrowed to both ends. Seed ovoid, with a conical point; vascular branches of the integument 8 or 9, slightly anastomosing.. 5. *P. heterophylla.*

a^2. Leaves with more numerous segments.

b^1. Segments ashy-puberulous underneath; plants of moderate size.

c^1. Fruits 3-seriate. Segments relatively not very numerous, very unequal, inequidistant, 3- to 7-costulate, deeply incised into 3 to 7 bifid laciniae, the latter falcate, acuminate. Spadix with few (5 or 6) branches. Fruits relatively large, ovoid-ellipsoid, 2.5 to 3.3 cm long. Fruiting perianth low, cupular, not contracted at the mouth. Stem 3 to 5 cm in diameter....................6. *P. Barnesii.*

c^2. Fruits 2-seriate.

d^1. Segments rather numerous, very unequal, 1-pluricostulate, sigmoidal; when with more than one midcosta then deeply cleft at the apex into falcate-acuminate points. Spadix with the upper branches spirally scattered. Fruit obovoid, 18 to 20 by 13 mm. Seed spherical, with a horizontal embryo fovea. Fruiting perianth very shallowly cupular or almost explanate.
7. *P. Copelandii.*

d^2. Segments numerous, 2- or 3-costulate, almost straight, not deeply incised at the apex, the divisions 2-toothed, the teeth acute. Fruit ovoid-ellipsoid, obtuse, small, 15 by 9 mm. Seed with a very oblique embryo fovea. Fruiting perianth shallowly cupular, with nearly vertical walls, not contracted at the mouth.
8. *P. Curranii.*

b^2. Segments glabrous underneath.

c^1. Spadix with rather few branches.

d^1. Fruits distichous. Small or medium-sized plants.

e^1. Stem 2 to 5 cm in diameter. Leaf-sheaths densely covered with a grayish tomentum. Segments rather numerous, slightly sigmoid, acuminate, usually 3-costulate and relatively broad, or else narrow and 1-costulate. Spadix with few, scattered or subdistichous branches. Fruit narrowly ovoid-ellipsoid, acuminate, 11 to 14 by 5 to 8 mm. Fruiting perianth cupular, contracted at the mouth..............................9. *P. philippinensis.*

e^2. Very similar to the preceding. Stem 2 to 4 m high, 2 to 5 cm in diameter. Leaf-sheaths covered with appressed rusty scales (not tomentose). Segments rather numerous and subequidistant; usually 1-costulate, slightly falcate acuminate or nearly straight. Spadix with a few scattered spreading branches. Fruit ovoid-ellipsoid, 12 to 14 by 7 to 8 mm. Fruiting perianth cupular, contracted at the mouth. 10. *P. Elmerii.*

e^3. Stem 2 to 3 cm in diameter. Leaf-sheaths sprinkled with dark-purple scales. Segments rather numerous, equidistant, 8 to 9 cm apart on each side of the rachis, 3-costulate, ensiform, about 60 cm long, 4 to 4.5 cm wide, paler or subglaucous, and not sprinkled with microlepidia underneath, the apices acuminate-caudate and very slightly falcate. Spadix with 14 or 15 spirally alternate branches. Immature fruits fusiform, 14 to 15 mm long (ovate-ellipsoid at complete maturity?). Fruiting perianth contracted at the mouth..11. *P. urdanetana.*

e^4. Of medium size (?). Segments lanceolate-ensiform, acuminate, unequal, straight, 60 cm long, 3.5 cm wide, their lower surface in the dry specimens reddish-brown and densely sprinkled with extremely minute, light-colored dots (microlepidia). Spadix with strongly flattened branches. Fruit thickly fusiform, equally narrowing to both ends, 15 to 18 mm long, and about 1 cm thick. Fruiting perianth very low, contracted at the mouth..12. *P. samarana.*

e^5. Of medium size. Segments very numerous, equidistant, approximate, long, narrow, slightly falcate, very acuminate, all unicostulate. Spadix with 5 or 6 much flattened branches. Fruit relatively large, ovoid-ellipsoid, conical-mammillate at the apex, the base narrow and subpedicelliform when dry, 23 to 32 mm long, 13 to 14 mm thick. Seed ovoid, suddenly prolonged at the base into a slender caudiculum; embryo fovea broad and slightly oblique; vascular branches of the integument simple on the raphal or dorsal side and anastomosing anticously. Fruiting perianth truncate, not contracted at the mouth.......................................13. *P. urosperma.*

d^2. Fruits 3-seriate, at least in the lower part of the branches.

e^1. Segments straight, not falcate at their apices. Plants of medium size. Fruits small.

f^1. Segments numerous, very approximate, inserted at a very acute angle, unicostulate, lanceolate-ensiform, quite straight, concolorous, the apex bifid, its divisions acuminate. Spadix with several spirally inserted branches. Fruits 3-seriate from the base to the end of the branches, ovoid-ellipsoid, the apices mammillate, 13 to 15 by 6 to 7 mm. Seed globular-ovoid, rounded above, not caudiculate at the base; embryo fovea oblique; vascular branches of the integument few (5 or 6), not or only very slightly divided. Fruiting perianth very low, 1.5 mm high, 4 mm broad, contracted at the mouth..........14. *P. rigida.*

f^5. Segments numerous, equidistant, 6 to 7 cm apart on each side of the rachis, ensiform, 1- or 2-costulate, straight, rigid, concolorous, very acuminate, bifid at the apex. Spadix with several, triquetrous, spirally inserted branches. Fruits 3-seriate in the lower part of the branches, bifarious near the end, small, 12 to 15 by 7 to 8 mm, ovoid-ellipsoid; seed ovoid, not caudiculate at the base; embryo fovea very oblique; vascular branches of the integument 5, all slightly anastomosing. Fruiting perianth low, 2 mm high, 4 mm broad, slightly contracted at the mouth.
15. *P. Woodiana.*

f^6. Segments numerous, equidistant, thickish and rigid, 1-costulate, concolorous, narrow, very long-acuminate. Spadix with several, 3-gonous, spirally inserted branches. Fruit broadly ovoid, 13 by 8 to 9 mm. Seed broadly ovoid; embryo fovea almost horizontal; vascular branches of the integument 8 or 9, of which two are undivided and pass over the apex, and 2 or 3 on each side are arched and slightly anastomosing. Fruiting perianth 2 mm high, 4 mm broad, contracted at the mouth........16. *P. sclerophylla.*

e^2. Segments falcate at their apices, numerous, equidistant, rigid, concolorous, narrow, very long-acuminate, 1- or 2-costulate. Spadix with several spirally inserted branches, trigonous in their lower part and flattened above. Fruit 3-seriate in the lower part of the branches, and bifarious above, rather narrowly ovoid-ellipsoid, narrowing a good deal to both ends, 12 to 13 by 6 mm. Seed caudiculate at the base; embryo fovea slightly oblique. Fruiting perianth contracted at the mouth.
17. *P. negrosensis.*

c^2. Spadix large with numerous branches inserted spirally at different levels. Large arboreous plants.

d^1. Fruits biseriate.

e^1. Segments very numerous, uniform, equidistant, ensiform, quite straight, rigid, very acuminate, very strongly 2-costulate, more or less deeply bifid at their apices, subconcolorous, very finely granulate-scabrid on the secondary and tertiary nerves on the lower surface. Fruits rather large, ovoid-ellipsoid, narrowing to both ends, 24 to 25 by 13 to 14 mm; pericarp containing several layers of capillary fibers. Seed obsoletely caudiculate at the base, the embryo fovea very broad, oblique. Fruiting perianth 3.5 mm high, 8 mm broad, not or only very slightly contracted at the mouth................18. *P. insignis.*

f^1. Fruit shorter than in the species and more ventricose, 20 to 22 by 13 to 14 mm............................*P. insignis* var. *gasterocarpa.*

f^2. Fruit narrower than in the species or thickly fusiform, 20 to 22 by 8 to 9 mm........................*P. insignis* var. *leptocarpa.*

f^3. Fruit very broadly ovoid, 20 to 22 by 13 to 15 mm. Pericarp with rigid fibers, rendering the surface of the fruit striate. Leaflets dusty-subglaucous underneath.
P. insignis subsp. *Loheriana.*

e^2. Segments very numerous, unicostulate, very approximate by twos on each side of the rachis, ensiform, quite straight, very acuminate. Fruits ovoid, broad at the base and suddenly apiculate-mammillate, 20 by 12 mm. Seed ovoid, blunt; vascular branches of the integument simple on the raphal side, elsewhere rather closely anastomosing. Fruiting perianth broadening at the mouth........19. *P. batanensis.*

e^3. Segments elongate-lanceolate, 3-costulate, 1 meter long or more, spadix with slender, strongly flattened, pendulous branches. Fruit of medium size, 20 by 12 mm, slightly obovoid or ovoid-olivaeform; pericarp somewhat fleshy, traversed by a few slender fibers. Seed relatively small, 13 by 8 to 9 mm. Fruiting perianth deeply cupular or subcampanulate, not contracted at the mouth, 4 mm high, 6 mm broad.
20. *P. basilanensis.*

e^4. Segments equidistant, large, straight, 2- to 3-costulate, of a rather herbaceous texture, the basilar and the intermediate segments acuminate, the upper with as many not very deep incisions as there are costae, and with the resulting divisions shortly 2-toothed. Fruits small, 15 by 9 mm, obovoid, rounded above. Seed oblong, the embryo fovea very slightly oblique; vascular branches of the integument almost simple.
21. *P. speciosa.*

d^2. Fruit 3-seriate. Segments ensiform, strongly bicostulate, the apex divided into two straight points. Fruits rather large, ovoid-ellipsoid, with a conical apex, 25 to 28 by 15 to 17 mm. Seed broadly ovoid, rounded above, the embryo fovea somewhat oblique; vascular branches of the integument much branched and forming a network all around the seed. Fruiting perianth somewhat contracted at the mouth.
22. *P. sibuyanensis.*

1. **PINANGA MACULATA** Porte in Illustr. Hort. **10** (1863) 92, 188, *t. 361*, Belgique Hort. (1863) 236; H. Wendl. in Kerch. Les Palms 253; Drude in Bot. Zeit. (1877) 637, *t. 5, f. 12–13* (ovulum); Becc. Malesia **3** (1886) 145, et in Perkins Fragm. Fl. Philip. (1904) 48, et in Webbia (1905) 325; Curtis's Bot. Mag. *t. 8011.*

PALAWAN, along Ewiig River, *Merrill 712* (sterile specimen).

Of this fine small *Pinanga* I have seen only the sterile specimen cited above. The leaves appear distinctly mottled even in the dry condition and have a petiole about 20 cm long; the blade, 30 cm long, has 9 or 10 main costae on each side of the rachis, tapers gradually to the base, and is divided down to its lower one-third into two lobes.

Fertile specimens received from the botanic garden at Buitenzorg, Java, under the name of *Pinanga maculata,* do not seem to me to differ from *P. disticha;* they have the uniformly green blade parted only to the middle, and the petiole is shorter and thicker than in the Palawan plant. Probably the leaves of young plants only are variegated and possibly also in gardens the very similar *Pinanga disticha* may also go under the name of *P. maculata.* In fact Ridley[1] actually reduces *P. maculata* to *P. disticha.* I think, however, that true *Pinanga maculata* of the Philippines is distinguishable from the Malayan *P. disticha* by the leaves having a longer petiole and the blade being more deeply bilobed. The flowers and the fruit probably offer other diagnostic characters, but I have not seen fertile specimens of the wild Philippine plant.

2. **PINANGA GEONOMAEFORMIS** Becc. in Philip. Journ. Sci. 4 (1909) Bot. 602.

LUZON, Tayabas Province, *For. Bur. 10155 Curran:* Laguna Province, San Antonio, *Bur. Sci. 20474 Ramos:* Rizal Province, Pantao, *Loher 7055* in Herb. Kew. and Becc.

3. **PINANGA MODESTA** Becc. in Philip. Journ. Sci. 2 (1907) Bot. 223.

MINDANAO, Davao District, *Copeland:* Lanao District, Camp Keithley, *Mary Strong Clemens 487:* Bukidnon Subprovince, *Bur. Sci. 15751 Fénix.* BASILAN, *For. Bur. 3987 Hutchinson.*

4. **PINANGA ISABELENSIS** Becc. sp. nov.

Gracilis, caudice 2 ad 2.5 cm diametro. Frondium vaginis squamuloso-pubescentibus, segmentis aequidistantibus, utrinque 8 vel 9 inter se remotis, elongato-ensiformibus et subfalcatis, acuminatissimis, 2- ad 4-costulatis, subtus glabris vel vix secus nervos papillosis; spadicis ramis paucis (5 vel 6); fructibus exacte distichis, anguste ovoideo-conicis, vel in dimidia inferiori parte latiusculis et superne conico-attenuatis, 16 ad 18 mm longis, 6 mm latis; semine elongato, apice conico, fovea embrionali obliqua; integumenti ramis vascularibus 3 vel 4, fere indivisis; perianthio fructifero cupulari truncato.

LUZON, Isabela Province, Biocbian Bay, *Bur. Sci. 10660 McGregor,* in beach forest, about 50 meters from the sea.

A slender plant, the stem 2 cm in diameter, with short internodes (3 to 4 cm long). The wood is very hard, and it is apparently a slow-growing plant, as the surface of the stem is covered with crustaceous lichens in its lower and older parts. Leaf-sheaths finely and softly tomentose. The only leaf seen by me is 90 cm long in the piniferous part; the petiole is 20 cm long, slightly scurfy, or sprinkled with brown scales; the segments are subopposite, very few (6 or 7) and 8 to 9 cm apart on each side of the rachis; two or three of the lowest segments are very narrow; the intermediate ones are elongate-ensiform,

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[1] (Mat. Fl. Mal. Penins. Monocot. 2 (1907) 139).

slightly sigmoidal and falcate above, very long and slenderly acuminate, 3- or 4-costulate, about 50 cm long and 3.5 to 4.5 cm broad, reddish-brown underneath in dry specimens and under a strong lens appear finely hairy-papillose along the nerves; the two terminal segments are narrowly linear, 2 to 2.5 cm broad and 30 cm long, truncate and shortly incised-toothed at the apex. Spadix small with a very few (5 or 6) flattened, about 13 cm long, floriferous branches. Fruits exactly biseriate, elongate-ovoid-conical, 16 to 18 mm long, 6 mm thick, having their broadest part below the middle and the base suddenly contracted into a caudiculum, the latter extending into the perianth. Seed ovoid-conical, 11 mm long, 5 mm thick, with the areola of the embryo oblique; the vascular bundles of the integument are 3 or 4 only, very slightly anastomosing. Fruiting perianth cupular, truncate, not contracted at the mouth, 2 mm high, 3.5 mm wide.

5. PINANGA HETEROPHYLLA Becc. sp. nov.

Gracilis, caudice 1.5 cm diametro. Frondium segmentis utrinque 7 vel 8, inaequidistantibus, valde inaequalibus, 1- ad 4-costulatis, falcato-sigmoideis, longe acuminatis, chartaceis, subtus glabris; spadicis ramis paucis (5) triquetris; fructibus 3-seriatis, parvis, anguste ovato-ellipsoideis, utrinque aequaliter attenuatis, acutis, 11 ad 12 mm longis, 5 ad 5.5 mm latis; semine ovato, superne conico; integumenti ramis vascularibus 8 ad 10, modice anastomosantibus.

NEGROS, Mount Maripari, *For. Bur. 17346 Curran*, September, 1909, in forests.

Slender, stem 15 mm in diameter. Leaf-sheaths elongated, 22 cm in one specimen, the mouth very oblique (not split) for the extent of 5 to 6 cm, strongly striate, and more or less covered with rusty-brown scales; the ligule at the base of the petiole is membranaceous, triangular, acuminate, 12 to 15 mm long; petiole 20 to 25 cm long, 3-gonous, also covered with rusty scales; the piniferous part is about 85 cm long, and has 7 or 8 segments on each side; the segments are very unequal, inequidistant, often separated by vacant spaces as much as 8 cm long; the lower surface is glabrous and paler than the upper, narrowly falcate-sigmoid, very acuminate; the intermediate segments are 35 to 40 cm long and of very variable breadth, some of them being 1-costulate, and only 7 cm broad, while others are 2- to 4-costulate and 2 to 4 cm broad; the two terminal segments are united by their bases and are shorter and broader than the others, pluricostulate, incised-toothed, the teeth divided again into two short, narrow, acuminate, secondary teeth. The spadix has very few branches (5 in the specimen at hand), spreading, triquetrous, 7 to 9 cm long. Fruits 3-seriate, small, narrowly ovoid-ellipsoid, equally attenuate at both ends, their apex acute, 11 to 12 mm long, 5 to 5.5 mm thick. Seed ovoid, conical in its upper part, 7.5 mm long, 5 mm thick, noncaudiculate at the base; areola of the embryo small, slightly oblique; vascular branches of the integument 8 to 10, ascending from the base, slightly anastomosing. Fruiting perianth cupular, truncate, slightly contracted at the mouth.

This species resembles *Pinanga Elmerii*, even as to its dimensions, but the fruits are 3-seriate.

6. **PINANGA BARNESII** Becc. in Webbia 1 (1905) 320, Philip. Journ. Sci. 3 (1908) Bot. 340, 6 (1911) Bot. 229.

Pinanga Barnesii var. *macrocarpa* Becc. in Philip. Journ. Sci. 2 (1907) Bot. 227.

LUZON, Bataan Province, Lamao River, *For. Bur. 122 Barnes* (type specimen), *For. Bur. 2762 Meyer:* Tayabas Province, Lucban, *Elmer 7924;* Kabibihan, *Bur. Sci. 13248 Ramos:* Cagayan Province, *For. Bur. 17756 Ramos:* Rizal Province, *Bur. Sci. 13419 Ramos:* No precise locality *Loher 7069, 7068* in Herb. Kew.: Union Province, Mount Tonglon, *Loher 7067* in Herb. Kew. POLILLO, *Bur. Sci. 6937 Robinson, Bur. Sci. 10466 McGregor.* BABUYAN ISLANDS, Camiguin, *Bur. Sci. 4144 Fénix.* MINDORO, *McGregor 275* (var. *macrocarpa*). The size of the fruit in the cited specimen is very variable as many are immature.

7. **PINANGA COPELANDI** Becc. in Webbia 1 (1905) 317.

MINDANAO, Davao District, Todaya, *Copeland 1283* Herb. Manila (type specimen), *Elmer 10467:* Butuan Subprovince, *Weber 1134, Bur. Sci. 15918 Fénix:* Agusan River, *Merrill 7281;* Mount Urdaneta, *Elmer 13875.* NEGROS, Gimagaan River, *Whitford 1669.* LUZON, Camarines Province, *Phil. Pl. 1594 Ramos.*

8. **PINANGA CURRANII** Becc. in Philip. Journ. Sci. 4 (1909) Bot. 226.

PALAWAN, near Puerto Princesa, *For. Bur. 3515 Curran.*

9. **PINANGA PHILIPPINENSIS** Becc. Malesia 3 (1887) 180, Perk. Fragm. Fl. Philip. (1904) 48, Webbia 1 (1905) 44.

LUZON, Sorsogon Province, Mount Bulusan, *Vidal 3950, 4064,* in Herb. Becc. (type specimens): Bataan Province, Mount Mariveles, *Whitford 333, Elmer 6825, Merrill 3316* (specimens very similar to the typical ones): Rizal Province, Mount Matulid, *Loher 7065* in Herb. Kew.: Tayabas Province, Mount Banahao, *Elmer 9300* (with very narrow, 1-costate, falcate segments): Cagayan Province, *For. Bur. 11317 Klemme:* Laguna Province, Mount Maquiling, *Bur. Sci. 13679 Ramos:* Benguet Subprovince, *Bur. Sci. 12907 Fénix.* The last four are with difficulty distinguishable from *P. elmerii* Becc.

10. **PINANGA ELMERII** Becc. in Webbia 1 (1905) 322, Philip. Journ. Sci. 3 (1908) Bot. 341.

BABUYAN ISLANDS, Camiguin, *Bur. Sci. 4149 Fénix.* LUZON, Benguet Subprovince, Baguio, *Elmer 6067, For. Bur. 10891 Curran, Bur. Sci. 12907 Fénix:* Ifugao Subprovince, Mount Polis, *Bur. Sci. 19782 McGregor* (a slender plant with very narrow leaflets, perhaps representing a distinct variety): Ilocos Norte Province, Mount Piao, *For. Bur. 14011 Merritt & Darling:* Nueva Vizcaya Province, *Bur. Sci. 11370, 20204, 20205 McGregor:* Bataan Province, Mount Mariveles, *Merrill 3846* (typical), *For. Bur. 1578 Borden, Whitford 130:* Rizal Province, *Bur. Sci. 13413 Ramos:* Laguna Province, Mount Maquiling, *Bur. Sci. 17119 Robinson:* Zambales Province, Mount Tapulao, *For. Bur. 8263 Curran & Merritt:* Tayabas Province, Mount Pular, *Bur. Sci. 19416 Ramos:* Without precise locality, *Loher 7064, 7063* in Herb. Kew. MINDORO, Mount Halcon, *Merrill 5555.* LEYTE, Dagami, *Bur. Sci. 15259 Ramos.*

Pinanga Elmerii is very closely related to *P. philippinensis*, and at times is distinguishable from it only with difficulty.

11. **PINANGA URDANETANA** Becc. sp. nov. in Leafl. Philip. Bot. MS.

MINDANAO, Agusan Province, Camilanan Peak, Mount Urdaneta, *Elmer 14137.*

12. **PINANGA SAMARANA** Becc. sp. nov.

Mediocris. Frondium segmentis intermediis rectis (apice minime falcato) inaequalibus, lanceolato-ensiformibus, 6 ad 7 cm inter se dissitis, 2–3-costulatis, 60 cm longis, 3.5 ad 6 cm latis, in sicco brunneis et subtus punctulis minutissimis pallidis conspersis; spadicis ramis valde complanatis; fructibus bifarius, crasse fusiformibus vel ovoideo-ellipticis, nonnihil utrinque attenuatis ac acutis, 15 ad 18 mm longis et circiter 10 mm crassis; perianthio fructifero parvo, 1.5 mm alto, 3 mm lato et in ore parum constricto.

SAMAR, Mount Cauayan, *Bur. Sci. 17535 Ramos,* March 29, 1914.

This is very incompletely known, as of it I have seen only a small portion of a leaf and fragments of the spadix bearing not thoroughly mature fruits. In the dry specimens the leaflets have the upper surface green, and the lower very minutely dotted and of a reddish-brown color. In general habit *Pinanga samarana* resembles *P. urdanetana,* but the fruits of the former are larger than those of the latter in which the leaflets of the dry specimens are brownish above and grayish-glaucescent underneath, without any traces of the very minute and numerous dots (microlepidia) peculiar to *P. samarana.*

13. **PINANGA UROSPERMA** Becc. in Philip. Journ. Sci. 3 (1908) Bot. 341.

BABUYAN ISLANDS, Camiguin, *Bur. Sci. 4044 Fénix.*

14. **PINANGA RIGIDA** Becc. in Leafl. Philip. Bot. 2 (1909) 642.

NEGROS, Cuernos Mountains, *Elmer 10187.*

15. **PINANGA WOODIANA** Becc. in Philip. Journn. Sci. 4 (1909) Bot. 604.

MINDORO, Mount Halcon, *Merrill 5680.* MINDANAO, Davao District, Mount Apo, *Elmer 10485* (the fruit a little larger than in the Mindoro specimen).

16. **PINANGA SCLEROPHYLLA** Becc. in Philip. Journ. Sci. 4 (1909) Bot. 603.

MINDORO, Mount Halcon, *Merrill 4468.*

17. **PINANGA NEGROSENSIS** Becc. in Leafl. Philip. Bot. 2 (1909) 642.

NEGROS, Dumaguete, Cuernos Mountains, *Elmer 10030.*

18. **PINANGA INSIGNIS** Becc. in Philip. Journ. Sci. 2 (1907) Bot. 223.

MINDORO, Bongabong River, *Whitford 1388* (type specimen). MINDANAO, Agusan Province, Mount Urdaneta, *Elmer 13950:* Surigao Province, *Bolster 222.* LUZON, Nueva Vizcaya Province, *Bur. Sci. 11233 McGregor:* Laguna Province, San Antonio, *Bur. Sci. 15111 Ramos:* Tayabas Province, Lucban, *Elmer 8028, Bur. Sci. 13236 Ramos:* Rizal Province, Siya Bundoc, *Loher 7059,* Herb. Kew. (All the Luzon specimens agree very well with the typical Mindoro form.) LEYTE, *Wenzel 534,* perhaps representing a local variety with narrower and more approximate fruits, but the fruits are very immature.

PINANGA INSIGNIS Becc. var. **GASTEROCARPA** Becc.

LUZON, Laguna Province, Mount Maquiling, *For. Bur. 7791 Curran & Merritt, Loher 7093,* Herb. Kew. NEGROS, *For. Bur. 17348 Curran;* Faraon, *For. Bur. 13560 Meyer & Foxworthy.* MASBATE, *For. Bur. 11555 Rosenbluth.*

PINANGA INSIGNIS Becc. var. **LEPTOCARPA** Becc.

NEGROS, Mount Silay, *Whitford 1621.*

PINANGA INSIGNIS Becc. subsp. **LOHERIANA** Becc.

LUZON, Laguna Province, Mount Banahao, 1,000 meters' altitude, *Loher 7092,* Herb. Kew. and Becc.

19. **PINANGA BATANENSIS** Becc. in Philip. Journ. Sci. 3 (1908) Bot. 340.

BATAN ISLANDS, Batan, Santo Domingo de Basco, *Bur. Sci. 3841 Fénix.*

20. **PINANGA BASILANENSIS** Becc. sp. nov.

Major; frondium segmentis intermediis ultra metralibus, 9 cm latis, elongato-lanceolatis, 3-costulatis, rectis; spadicis ramis gracilibus, fructiferis pendulis, valde compressis; fructibus e ramorum basi usque ad apicem distichis, ovoideo-olivae formibus, aut laeviter obovatis, 2 cm longis, 12 mm latis; pericarpio nonnihil carnoso, fibris tenuibus paucis percurso; semine pro rata parvo, 13 mm longo, 8 ad 9 mm crasso, oblongo, apice rotundato; perianthio fructifero profunde cupulari vel subcampanulato in ore non coarctato, 4 mm longo, 6 mm lato.

Apparently a large species of the dimensions of *P. insignis.* The only leaf-segment seen by me is strongly 3-costulate, 106 cm long and 9 cm broad in its intermediate part, elongate-lanceolate, straight, narrowed a little in its lowest part but, nevertheless, attached to the rachis by a broad base; it narrows also in its upper part, and has the upper margin prolonged into an acuminate straight point, whereas the lower margin, toward the apex, is marked by several narrow teeth, the upper teeth gradually surpassing in length those below; in the dry state the segment is concolorous on both surfaces, the lower surface is glabrous, but is covered (occasionally?) with small granulations pertaining to the parenchyma, which are wanting or are much less visible on the upper surface. The spadix is apparently large and has numerous slender, floriferous branches, about 30 cm long; the latter are strongly flattened and bear the fruits in two series, even on their lowest parts. Fruit ovoid-olivaeform or very slightly obovoid, apex round, slightly narrowed toward the base, 2 cm long, 12 cm thick; the pericarp contains a few slender fibers and has the appearance of having been rather fleshy at maturity. Seed oblong, rounded above, relatively small, 13 mm long, 8 to 9 mm thick; the embryo area slightly oblique; the vascular branches of the integument rather numerous, but slightly anastomising. Fruiting perianth rather deeply cupular-subcampanulate, broadening a little at the mouth, 4 mm high and 6 mm broad.

BASILAN, *Bur. Sci. 16119 Reillo.*

This is related to *Pinanga insignis,* but is distinguishable by the fruiting perianth being slightly widened, not contracted, at the mouth and relatively very deep and nearly campanulate; by the fresh mature fruit being pulpy and with few fibers; by the leaf-segments having the lower margin near the apex incised-toothed, the teeth looking like ascending steps (this character is probably present in some segments only).

21. **PINANGA SPECIOSA** Becc. in Webbia 1 (1905) 316.

MINDANAO, Davao District, Todaya, *Copeland 1265, Elmer 10484,* locally known as *sadawag:* Lanao District, Camp Keithley, *Mary Strong Clemens 374:* Zamboanga District, *For. Bur. 9271 Whitford & Hutchinson:* Agusan Province, Cabadbaran, *Elmer 13739, 13941, 14023,* locally known as *salacon* and *saraway.*

A large palm with a relatively slender stem, 8 to 10 m high, 10 to 12 cm in diameter. Leaves large, the segments numerous, uniform, equidistant, 7 to 10 cm apart, of a not very rigid structure (perhaps rather herbaceous when fresh), glabrous, straight, lanceolate-ensiform, narrowed somewhat toward the base; the lower and intermediate segments very long-acuminate, usually 2-costulate, 1 to 1.2 m long, 8 to 10 cm wide, the upper ones gradually shorter, not very deeply 2- or 3-lobed at the apex, the lobes shortly 2-toothed. Spadix large, divided into several, spirally alternate, strongly flattened floriferous branches, the lower of which are 30 to 40 cm long, and the upper gradually shorter. The fruits are exactly distichous throughout the entire length of the branches, small, obovoid, apex round, base (in the part included in the perianth) acute, 15 to 17 mm long and 9 mm thick. Seed oblong, rounded above, 10 to 11 mm long, 7 mm thick, with the areola of the embryo very slightly oblique; vascular branches of the integument almost simple. Fruiting perianth shallowly cupular, very slightly broadening at the mouth, 2.5 to 3 mm high, 5 mm broad.

This was first described from very incomplete material. The various specimens with fruits, received later, correspond very well to the typical ones, which had flowers only. All the herbarium specimens I have examined have acquired a uniform yellowish tint on both surfaces, are not very rigid but rather flexible, and look as if they had been rather herbaceous in the living plant.

22. PINANGA SIBUYANENSIS Becc. sp. nov.

Inter majores, subelata, caudice ad 9 m longo, 15 cm diametro; frondium segmentis numerosis, aequidistantibus, late ensiformibus, usque ad apicem rectissimis, utrinque virentibus, subtus paullo pallidioribus, validissime bicostulatis, apice inaequaliter bifidis; spadicis ramis numerosis, spiraliter insertis; fructibus 3-seriatis, majusculis, 25 ad 28 mm longis, 15 ad 17 mm latis, ovato-ellipticis, utrinque aequaliter attenuatis; semine late ovato, superne rotundato; fovea embryonali nonnihil obliqua; integumenti ramis vascularibus numerosis, undique reticulatim anastomosantibus; perianthio fructifero ad faucem nonnihil coarctato.

SIBUYAN, Mount Giting-Giting, *Elmer 12425*.

This is allied to *Pinanga insignis*, but is apparently a smaller plant yet with larger fruits, and with the vascular branches of the integument forming a network all around the seed.

ACTINORHYTIS Wendland et Drude

ACTINORHYTIS CALAPPARIA Wendl. et Dr. in Linnaea 39 (1875) 184.

MINDANAO, Davao District, Todaya, *Elmer 11238*, with the local name *tangalo*.

A fine but almost useless palm, very widely spread in the Malay Archipelago and in the Moluccas, but probably of foreign origin in the Philippines.

HETEROSPATHE Scheffer

Conspectus of the species.

a¹. Large trees.

  b¹. A tree 8 to 10 m high. Leaflets with strong secondary nerves, the midrib without paleolae underneath. Spadix three times branched, floriferous branches slender. Fruit globular, 7 to 7.5 mm in diameter, excentrically apiculate, the surface granulose from short scattered sclerosomes. Seed spherical................................ 1. *H. elata.*

  b². A tree as much as 9 m high, 12 cm in diameter. Leaflets having rather distinct secondary nerves, and the midrib furnished underneath with conspicuous brown paleolae. Spadix three times branched; floriferous branches thickish (2.5 mm thick). Fruit ovoid, 1 cm long, 7 mm thick, having the point conical and slightly oblique and the surface shagreened by linear sclerosomes. Seed globose-ovoid, blunt.. 2. *H. sibuyanensis.*

a². Shrubs or small trees.

  b¹. Stem slender, 1 to 3 m high, 2 to 3 cm in diameter. The largest leaflets 25 to 30 cm long, 10 to 15 mm broad, secondary nerves faint. Spadix twice branched in its basal part, simply branched above. Fruit ovoid, 10 to 11 mm long, 6 mm thick, very suddenly, and nearly centrally, apiculate, the surface closely shagreened by conspicuous, shortly fusiform sclerosomes. Seed globose-ovoid, blunt. 3. *H. philippinensis.*

  b². More robust than the preceding, 3 to 5 m high. Stem 4 to 5 cm in diameter. Leaflets 35 to 40 cm long, 2 to 2.5 cm wide, the secondary nerves rather distinct. Spadix twice branched. Fruit ovoid-ellipsoid, narrowing above to a conical, nearly symmetrical point, 9 to 11 mm long, 5 mm thick. Seed ovoid, acute. 4. *H. negrosensis.*

1. **HETEROSPATHE ELATA** Scheff. in Ann. Jard. Bot. Buitenz. 1 (1876) 141, 162; Becc. in Webbia 1 (1905) 328; Farnsworth Philip. Bur. Ed. Bull. 54 (1915) 66, 67, *plate.*

LUZON, Tayabas Province, *For. Bur. 10352 Curran:* Camarines Province, *For. Bur. 10481 Curran:* Cagayan Province, *For. Bur. 17064 Curran:* Laguna Province, Mount Maquiling, *For. Bur. 19749 Villamil.* CEBU, *Piper 4.* MINDANAO, Zamboanga District, *For. Bur. 9030 Whitford & Hutchinson:* Davao District, Todaya, *Elmer 11968.* MINDORO, Bongabong River, *Whitford 1395.* Local names: *Saguisi, sagisé, seguise, niog-niogan, tagisi, balaniug, salaniog.*

2. **HETEROSPATHE SIBUYANENSIS** Becc. in Leafl. Philip. Bot. MS.

SIBUYAN, Mount Giting-Giting, at about 230 meters' elevation, *Elmer 12350,* local name *bilis.*

This is the representative of *Heterospathe elata* in Sibuyan. It differs from *H. elata* in the leaflets being furnished with conspicuous paleolae on the lower surface; in the fruit being ovoid, with an obliquely conical upper part; and in the seed being slightly longer than broad (not spherical).

3. **HETEROSPATHE PHILIPPINENSIS** Becc. in Philip. Journ. Sci. 4 (1909) Bot. 610.

Ptychoraphis philippinensis Becc. in Ann. Jard. Bot. Buitenz. 2 (1885) 90, Webbia 1 (1905) 47, Cuming Exsicc. No. 1476 in Herb. Webb. at Florence.

LUZON, Benguet Subprovince, *For. Bur. 10856 Curran, For. Bur. 18019 Merritt:* Ifugao Subprovince, Mount Polis, *Bur. Sci. 19784, 19785 McGregor:* Nueva Vizcaya Province, *Bur. Sci. 8198 Ramos:* Camarines Province, *For. Bur. 21752 Fischer:* Rizal Province, Mount Matulid, *Loher 7054.* LEYTE, Dagami, *Bur. Sci. 15260 Ramos.*

4. **HETEROSPATHE NEGROSENSIS** Becc. in Philip. Journ. Sci. 4 (1909) Bot. 611.

NEGROS, Mount Silay, *Whitford 1539;* Cuernos Mountains, *Elmer 9439, 10147;* Mount Maripari, *For. Bur. 13639 Curran & Foxworthy. Bur. Sci. 9443, 9358 Robinson* are doubtfully referable to *Heterospathe negrosensis;* both were collected at about 900 meters' altitude on Mount Binuang, Infanta, Tayabas Province, Luzon. In regard to *9358* the collector notes that it is a plant 2 m high with the trunk 7 cm in diameter (this is probably the diameter of the upper part of the stem when covered with the mass of petiolar bases) and of the other that it is 4 m high.

PTYCHORAPHIS Beccari

Conspectus of the species.

a^1. Fruit longer than broad.

b^1. Of medium size. Leaflets furnished underneath with a few paleolae on the midrib only. Spadix twice branched. Fruit narrowly ovoid, tapering above to a slightly oblique, conical point, 10 to 12 mm long, 5 mm thick. Seed ovoid-ellipsoid, subacute, 7 mm long, 4 mm thick; vascular branches of the integument loosely anastomosing. 1. *Pt. microcarpa.*

b^2. Of medium size. Leaflets furnished underneath with paleolae, often on three nerves. Spadix twice branched. Fruit ovoid-ellipsoid, not or very slightly and asymmetrically obtuse-acuminate, 12 mm long, 7 mm thick. Seed ovoid, rounded at both ends; vascular branches of the integument very closely anastomosing. 2. *Pt. intermedia.*

b^3. Robust, stem about 15 m high. Spadix thrice branched. Leaflets rigid, without paleolae on the lower surface; secondary nerves well marked; margins somewhat thickened. Fruit narrowly ovoid, tapering above to a conical, slightly oblique point, 12 to 13 mm long, 5 mm broad. Seed ovoid-ellipsoid, acute, 9 mm long, 4.5 mm thick; vascular branches of the integument loosely anastomosing. 3. *Pt. Elmerii.*

a^2. Fruit spherical. Stem about 6 m high. Leaflets long-acuminate, the point slightly falcate. Spadix thrice branched, floriferous branches 12 to 15 cm long, 2.5 to 3 mm thick. The bracteoles of the female flower form a regular cupular caliculum. Fruiting perianth shallowly cupular. Fruit spherical, 7 mm in diameter, with the remains of the stigmas nearly central and apical, the surface not granulose. Seed spherical, 5.5 mm in diameter .... 4. *Pt. cagayensis.*

1. PTYCHORAPHIS MICROCARPA Becc. sp. nov.

Mediocris; frondium segmentis numerosissimis, rectissimis, majoribus 70 cm longis, 3.5 cm latis, costa media tantum subtus paleolis induta; spadice duplicato-ramoso, ramis floriferis rigidis, crassiusculis; fructibus anguste ovoideis, superne vix oblique conice attenuatis, 10 ad 12 mm longis, 5 mm crassis; semine ovato-elliptico, subacuto, 7 mm longo, 4 mm crasso; integumenti ramificationibus vascularibus laxe anastomosantibus.

Apparently of medium size. Leaves rather large, perhaps about 3 m long, very regularly pinnate; petiolar part smooth, strongly convex underneath, deeply channeled above (at least in its uppermost part); rachis also convex, smooth and glabrous underneath, 2.5 cm wide in its basal part. Leaflets very numerous, equidistant, ensiform, quite straight, attached to the rachis by a rather narrow base, with the margins there strongly reduplicate, very long acuminate in their upper part to a slender undivided point, which however has a tendency to split down the middle, firmly papyraceous, glabrous and subconcolorous on both surfaces, the margins slightly thickened; midrib almost equally prominent on both surfaces, provided, on the lower surface, especially near the base, with distant, brown, linear paleolae; the latter at times present (on each side of the midcosta) on a secondary nerve, which is usually stronger than the other; tertiary nerves not very sharp, being immersed in the parenchyma; transverse veinlets obsolete; intermediate segments up to 70 cm long, and 3.5 cm wide; the lowest segments considerably smaller; the upper ones gradually diminish in length and breadth; all, however, are of one shape. Spadix over 1 meter in length, but about one-half of it consists of an undivided, strongly flattened, peduncular part; the latter is 17 to 18 mm wide, the margins obtuse, covered with a very dark tobacco-colored, furfuraceous scurf; panicle diffuse, twice branched, its primary divisions short, angular, and subdivided into 2 or 3 floriferous branches; the latter are rigid, thickish (4 mm thick) throughout their entire length (not including the flowers), 15 to 22 cm long, uniformly covered with glomerules from the base to the apex, each composed of three flowers. Spathes two, falling to pieces at the time of fruiting, the outer, or basal, spathe coriaceous, brittle; the second inserted on the peduncular part 15 cm above the other. Glomerules not very regularly yet rather closely arranged, although often with vacant spaces interposed, around the branches, on very shallow scrobiculi. Male flowers * * *. Female flowers * * *. Fruiting perianth 5 mm high, the petals twice as long as the sepals; the bracts of the female flowers form a shallow truncate cup, 3 mm wide. Fruit narrowly ovoid, 10 to 12 mm long, 5 mm broad, slightly asymmetrical, being faintly obliquely conical in its upper part, the apex marked by a minute mammillaeform areola, bearing the remains of the stigmas; the surface is dull and even (not roughened by underlying sclerosomes), the epicarp thinly crustaceous, the mesocarp with 3 or 4 layers of strongly flattened, yet soft, fibers, the endocarp very thin, pellicular. Seed ovoid-ellipsoid, rather acute, 7 mm long, 4 mm thick; hilum sharply impressed all along one side; testa brown and polished; the vascular branches of the integument form a loose network all around the seed; albumen radiately ruminate; embryo basal.

CAMIGUIN DE MISAMIS, a small island north of Mindanao, *Bur. Sci. 14678 Ramos.*

This species is closely related to *Ptychoraphis intermedia,* but is distinguishable by its smaller fruits, considerably narrowing in their upper part, and by the ellipsoid, acute seeds having the vascular branches loosely anastomosing.

2. PTYCHORAPHIS INTERMEDIA Becc. in Leafl. Philip. Bot. MS.

MINDANAO, Agusan Province, between Duras and Canilan Peaks, Mount Urdaneta, over 1,000 meters' altitude, *Elmer 13663,* September, 1912, Manobo name *marighoy.* BILIRAN, *Bur. Sci. 18107 McGregor,* June, 1914, this specimen agreeing very well with that from Mindanao.

This species is closely related to *Ptychoraphis microcarpa,* from which it differs in its larger spadix having longer and thicker fructiferous branches and in the leaflets having paleolae not only on the midcosta but also on three nerves underneath, but more especially in the shape and size of the fruit and in the seed, which is rounded at both ends and marked by the close network of the vascular branches of the integument. Both *Ptychoraphis microcarpa* and *Pt. intermedia* are more closely related to *Pt. angusta,* of the Nicobar Islands, than to *Pt. singaporensis,* of the Malay Peninsula and Singapore.

8. PTYCHORAPHIS ELMERII Becc. comb. nov.

Heterospathe Elmerii Becc. in Leafl. Philip. Bot. 2 (1909) 646.

NEGROS, Dumaguete, Cuernos Mountains, *Elmer 9559,* altitude about 1,000 meters, local name *bilisan.*

4. PTYCHORAPHIS CAGAYENSIS Becc. comb. nov.

Heterospathe cagayensis Becc. in Philip. Journ. Sci. 4 (1909) Bot. 611.

LUZON, Cagayan Province, *For. Bur. 12286 Klemme,* locally known as *dumayaca.*

An imperfectly known palm, somewhat uncertain in its generic position, but greatly resembling *Heterospathe elata* in its fruit;

the fruit of the latter, however, has a smooth (not granulose) surface, the pericarp apparently being without sclerosomes. For this reason I have thought proper to transfer it from the genus *Heterospathe* to *Ptychoraphis*. The fruit is spherical, almost centrally apiculate, 7 mm in diameter, and has the hilum conspicuously marked all along one side. The spadix is thrice branched, and its fruiting branches are thicker than in *Heterospathe elata* (2.5 to 3 mm in diameter), almost torulose; the scrobiculi are approximate, have a raised rim, and the floral bracts form a shallow cup; the fruiting perianth is very shallowly cupular and does not have a pedicelliform appearance. The leaflets have slightly falcate apices with no paleolae underneath on the midrib.

ADONIDIA Beccari genus novum

Normanbyae sp. Becc. in Philip. Journ. Sci. 4 (1909) Bot. 606.

After a more complete revision of all the palms belonging to the Ptychospermeae I now think it advisable to establish an autonomous genus for the Philippine palm which was formerly considered by me as a member of the Australian genus *Normanbya*, in consideration of the fact that, notwithstanding the great similarity in the flowers and fruit, *Adonidia* differs greatly from *Normanbya Muellerii* in the leaves, the vegetative characteristics being of great importance in the delimitation of the genera of the subtribe of Ptychospermeae. In *Adonidia* the leaflets are regularly set, narrow, elongate, acuminate, bifid at the apex, 1-costulate, and with a strong nerve at both margins; whereas in *Normanbya* the leaflets are very peculiarly arranged in groups, each group resulting, apparently, from the spliting of one leaflet into several, which yet remain united by their bases; furthermore, the resulting leaflets are narrow, have a truncate praemorse apex, and have no marginal nerves.

The separation of *Adonidia* from *Normanbya* gives us a genus peculiar to the Philippines and the only endemic one in the family.

1. ADONIDIA MERRILLII Becc. comb. nov.

Normanbya Merrillii Becc. in Philip. Journ. Sci. 4 (1909) Bot. 606, *t. 30, 31.*

PALAWAN, in sandy soil of the woods fronting the beach south of Brooke's Point, *Elmer 12708*, February, 1911, locally known as *oring-oring;* Apulit Island, Taytay Bay, on the coast of Palawan, growing abundantly, often gregariously, on steep limestone slopes, altitude 10 to 100 meters, *Merrill 9415*, May, 1913. The species is commonly cultivated in Manila for ornamental purposes.

ORANIA Blume

Representatives of *Orania* are rather common in the forests of the Philippines, especially in the more southern islands of the group, but their specific delimitation is often difficult and uncertain, as individuals apparently belonging to the same species seldom exhibit constant characters, when growing in separate islands, or even in remote localities in the same island. This is not confined to *Orania*, but is an almost general occurrence in other genera of Philippine palms.

After a careful study of the specimens that offer the greatest divergence of characters, especially in the flowers and the fruits, I have concluded that there exist in the Philippines three primary species of *Orania;* namely, *Orania philippinensis, O. rubiginosa*, and *O. decipiens* (*O. paraguanensis* is perhaps only a derivation from *O. philippinensis*); but numerous variations are presented by these main types, especially in the size and shape of the fruits and in the thickness of their mesocarps, so as to render not inconsistent the opinion that in the Philippines we have only one "synspecies" of *Orania*, represented by several "microspecies" the latter however derived, we may suppose, by the interbreeding of two foreign elements. *Orania philippinensis* is apparently derived from the Papuan *O. regalis*, of which varieties or allied species exist also in the Moluccas; whereas the more typical form of *O. decipiens* is plainly allied to the Malayan *O. macrocladus*.

Conspectus of the species.

*a*¹. Floriferous branches ultimately glabrous.

  *b*¹. Male flowers angular, lanceolate, 6 to 8 mm long, 3 to 3.5 mm broad, or about twice as long as broad, having the stamens one-third to one-half shorter than the petals; anthers linear-oblong. Female flowers broadly ovate-trigonous, the calyx cupular, very low; petals triangular, subaequilateral. Fruit spherical or very slightly narrowed at the base, usually 5.5 to 6 cm in diameter, at times somewhat less; mesocarp about 5 mm thick........................ 1. *O. philippinensis.*

    *c*¹. Fruit exactly spherical, larger than in the species (6.5 cm in diameter), yet with a thinner mesocarp (3.5 to 4 mm thick). *O. philippinensis* var. *sibuyanensis.*

  *b*². Male flowers narrow, linear, 8 mm long, 2 mm broad, or about four times as long as broad, having the stamens nearly as long as the petals and the anthers very narrowly linear. Fruit spherical, smaller than in *O. philippinensis*, 4.5 to 4.7 cm in diameter, the mesocarp 3.5 to 4 mm thick.. 2. *O. paraguanensis.*

  *b*³. Male flowers narrowly linear. Fruit slightly narrowing to the base, or slightly pyriform, considerably smaller than in the preceding species, 4 to 4.5 cm long, 35 to 37 mm thick; kernel spherical, extended at the base into a broadly obconical blunt point; mesocarp relatively thick (3 to 4 mm) and furnished with many short and stout woody fibers. Seed about 25 mm in diameter.. 3. *O. decipiens.*

*c*¹. Fruit smaller than in the species (37 mm long, 31 to 32 mm thick), but always more or less narrowing to the base; mesocarp also thinner (2.5 mm thick)............... *O. decipiens* var. *mindanaoensis.*

*c*². Fruit spherical, not narrowing to the base, 42 mm in diameter; mesocarp 4 to 5 mm thick....................... *O. decipiens* var. *montana.*

*a*². Floriferous branches more or less permanently rusty-tomentose. Male flowers very narrow and long, 1 cm long, 2 to 3 mm broad. Female flowers pyramidate-trigonous, acuminate, twice as long as broad, calyx campanulate. Fruit subpyriform, 40 to 45 mm long, 30 to 38 mm thick; mesocarp thin, 1.5 to 2 mm thick....................... 4. *O. rubiginosa.*

1. **ORANIA PHILIPPINENSIS** Scheff. ex Becc. in Ann. Jard. Bot. Buit. 2 (1885) 156, *t. 14;* Becc. in Webbia 1 (1905) 335.

Orania Palindan Merr. in Govt. Lab. Publ. 27 (1905) 88, Philip. Journ. Sci. 1 (1906) Suppl. 32.

Palindan Blanco Fl. Filip. (1837) 444 (partly ?).

Caryota Palindan Blanco Fl. Filip. ed. 2 (1845) 513 ?

LUZON, Bataan Province, Mount Mariveles, *For. Bur. 1610 Borden,* this number with mature spherical fruits agreeing entirely with Scheffer's typical specimens: Tayabas Province, *For. Bur. 10410 Curran,* fruit slightly smaller than in Borden's specimen and slightly narrowed below, 5.3 cm long, 4.5 cm thick: Laguna Province, Calauan, *Bur. Sci. 12391 McGregor:* Zambales Province, *For. Bur. 8413 Curran & Merritt:* Cagayan Province, *For. Bur. 17068 Curran;* the last three specimens have immature fruits.

ORANIA PHILIPPINENSIS Scheff. var. **SIBUYANENSIS** Becc. var. nov.

SIBUYAN, along Patao River, Mount Giting-Giting, *Elmer 12066,* local name *banga.*

A tree about 5 m high, the stem 12 cm in diameter. Spadix about 1.50 m long; one spathe, persistent and coriaceous, is 1.40 m long, lanceolate, 5 cm broad, slightly rusty-furfuraceous outside. Fruit of a citron-yellow color.

2. **ORANIA PARAGUANENSIS** Becc. in Webbia 1 (1905) 335.

PALAWAN (Paragua), Taytay, *Merrill 9269, Merrill Phil. Pl. 1316;* Separation Point, *Merrill 869* (type specimen).

This is the representative in Palawan of *O. philippinensis* and perhaps should be considered as a variety of that species. It was first described by me from incomplete specimens, the fruits attached on very thick (perhaps abnormal?) branchlets (*Merrill 869*). Other specimens subsequently collected also by *Merrill* in Palawan at Taytay (*1316* and *9269*) have floriferous branches not differing from those of the typical *O. philippinensis* from Luzon, but have the male flowers much narrower than in that form, linear, 8 mm long, 2 mm thick, with stamens as long as the petals, and very narrowly linear anthers. The fruits are somewhat smaller than in the Luzon plant, 45 to 47 mm in diameter, with the mesocarp 3.5 to 4 mm thick.

3. **ORANIA DECIPIENS** Becc. in Philip. Journ. Sci. 4 (1909) Bot. 614.

MINDORO, Bongabong River, at about 70 meters above the sea level, *For. Bur. 4120 Merritt*, Tagalog and Visayan name *banga.*

This is distinguishable by its relatively small fruit, yet having a thick mesocarp. In the size and the shape of the fruit *O. decipiens* could be mistaken for *O. macrocladus*, and among the Philippine species, for *O. rubiginosa*, but in these the mesocarp is rather thin, whereas it is relatively very thick in *O. decipiens.*

ORANIA DECIPIENS Becc. var. **MINDANAOENSIS** Becc. var. nov.

MINDANAO, Zamboanga District, Port Banga, *For. Bur. 9179 Whitford & Hutchinson.*

Fruit a little smaller than in the species, 37 mm long, 31 to 32 mm thick, slightly narrowing to the base; mesocarp 2.5 mm thick.

ORANIA DECIPIENS Becc. var. **MONTANA** Becc. var. nov.

MINDANAO, Davao District, Mount Apo, at about 1,000 meters' altitude, *Elmer 11881:* Agusan Province, Cabadbaran (Mount Urdaneta), at about 830 meters' altitude, *Elmer 13970.*

The fruit is exactly spherical or else slightly broader than high, 42 mm in diameter; mesocarp 4 to 5 mm thick. In *Elmer 13970* the male flowers are very narrowly linear, 7 to 9 mm long, 2 mm broad.

4. **ORANIA RUBIGINOSA** Becc. sp. nov.

Frondium rachi et spadicis parte axilli et ramis ferrugineo-scrophulosis; floribus masculis angustissimis, 1 cm longis; floribus foemineis trigono-pyramidatis, acuminatis; fructibus globoso-subpyriformibus, quam in *O. philippinensi* minoribus, mesocarpio tenui (1.5 ad 2 mm spisso).

Apparently a smaller plant than *Orania philippinensis*, 6 to 8 m high, the stem 10 to 15 cm in diameter, the leaves also smaller and with fewer and narrower leaflets, the latter about 30 on each side of the rachis. Base of the leaves and rachis covered, especially underneath, with a rusty, very appressed indumentum, evanescent in age. The leaflets have on each side of the midrib 2 or 3 very strong secondary nerves, especially prominent on the lower surface near the base; the intermediate segments are 60 to 70 cm long and 3.5 to 4 cm broad, very obliquely truncate, and erose-toothed at the apex, and prolonged along the upper margin into a somewhat elongated point; in the upper leaflets the apex is truncate, irregularly lobulate and erose-toothed; the lower surface is as usual whitish and is, furthermore, sprinkled, especially in newly expanded leaves, with minute rusty scales (microlepidia), and has the upper margin marked by a rusty furfuraceous band. The spadix has more or less permanently rusty-furfuraceous, 10 to 20 cm long or less, floriferous branches, bearing on their lower parts a few female flowers, each of which is accompanied, as usual, on each side, by a male flower; the upper parts of the branches present male flowers only. The male flowers are very narrow, 1 cm long and 2 to 3 mm broad, sinuous, acuminate; calyx very shortly campanulate, sharply 3-toothed; petals about five times longer than the calyx, narrowly lanceolate, with the tips acuminate and more or less falcate; stamens 6, slightly shorter than the petals; filaments short; anthers linear, sinuous, emarginate at the apex. Female flowers pyramidal-trigonous, acuminate, 6 to 8 mm long; calyx relatively large, shallowly cupular, with three, broad, acuminate teeth, but latter splitting into three broad lobes; corolla about two and one-half times as long as the calyx; petals elongate-triangular, acuminate, 6 to 7 mm long, 3 mm broad at their bases; staminodia 6, subulate, not bearing rudimentary anthers. Fruiting perianth measuring about 9 mm between the tips of the petals. Fruit globose, slightly diminishing toward the base, or subpyriform, 4 to 4.5 cm long, 3 to 3.8 cm broad; mesocarp relatively thin, 1.5 to 2 mm thick; kernel, when detached from the mesocarp, with a blunt, not clearly defined prominence at the base; walls of the endocarp 0.33 mm thick at the sides. Seed globular with a flattish base, the vascular branches of the integument few, ascending, sinuous, not or very slightly divided. Embryo very slightly and excentrically apical.

LUZON, Cagayan Province, on the east coast, *Bur. Sci. 10575 McGregor, For. Bur. 17259, 17192 Curran:* Isabela Province, Biocbian Bay, *Bur. Sci. 10658 McGregor:* Tayabas Province, Tagcauayan, *Bur. Sci. 13390 Ramos.*

This is easily distinguishable from *Orania philippinensis* by the general rusty coating which covers the leaf-rachis and the axial parts of the spadix; by its long and narrow male flowers, three to four times longer than broad; by the trigonous, acuminate female flowers having a campanulate calyx, and the petals elongate-triangular, twice as long as broad, at least; and by the subpyriform fruit, considerably smaller than that of *O. philippinensis*, and with a thin mesocarp.

Apparently also referable to *O. rubiginosa* is *Loher 7090* collected at Angilog, Rizal Province, Luzon (Herb. Kew.), of which the collector notes that it is a tree 3 to 4 m high with a thick stem. In this specimen the leaflets are larger than in the type, and the fruits also are somewhat larger, 5 cm long and 4 cm thick, and have the mesocarp 2.5 mm thick.

ARENGA Labillardière

Conspectus of the species.

*a*¹. Leaflets elongate, narrow, having smooth or remotely and minutely toothed margins, the secondary nerves parallel, all starting from the base.
  *b*¹. Large, with solitary stems. Fruit more or less turbinate, 3 cm or more in diameter. Male flowers with very numerous stamens; anthers aristate........ 1. *A. saccharifera.*
  *b*². Relatively small and caespitose. Male flowers with 20 to 30 stamens; anthers blunt or slightly apiculate. Fruit spherical, 15 to 18 mm in diameter........ 2. *A. mindorensis.*
*a*². Leaflets elongate, yet broad, margins very irregularly undulate or else very boldly toothed, or lobed; secondary nerves divergent from the rachis at different levels.
  *b*¹. Caespitose; stem attaining 2 to 3 m in height and 15 cm in diameter. Male flowers with a rounded top. Stamens about 150. Fruit longer than broad, rounded at both ends........ 3. *A. tremula.*
  *b*². Stem short and thick, about 30 cm in diameter. Male flowers apiculate. Stamens about 100. Fruit spherical........ 4. *A. Ambong.*

1. **ARENGA SACCHARIFERA** Labill. in Mém. Inst. Fr. 4 (1801) 209; Griff. Palms Brit. Ind. (1845) 164, *t. 135A;* Becc. in Perkins Fragm. Fl. Philip. (1904) 48, Philip. Journ. Sci. 6 (1911) Bot. 229.

Saguerus saccharifer Wurmb in Verh. Bat. Genootsch. 1 (1779) 350; Blume Rumphia 2 (1836) 128, *t. 123–4.*

LUZON, Tayabas Province, Lucban, *Elmer 7644;* Guinayangan, *Merrill 2043.* POLILLO, *Bur. Sci. 9041 Robinson, Bur. Sci. 10468 McGregor.* BILIRAN, *Bur. Sci. 18941 McGregor.*

2. **ARENGA MINDORENSIS** Becc. in Perkins Fragm. Fl. Philip. (1904) 48, Webbia 1 (1905) 49.

MINDORO, Calapan, *Merrill 1790* (type), *For. Bur. 8768 Merritt,* locally known as *dumayaca.* LUZON, Tayabas Province, Atimonan, *For. Bur. 10203 Curran;* Mauban, *Bur. Sci. 19468 Ramos,* with the female flowers well developed, the staminate ones not yet open: Bataan Province, *For. Bur. 5469 Curran:* Laguna Province, Calauan, *Bur. Sci. 12395 McGregor.* MINDANAO, Davao District, Mount Apo, *Elmer 11192,* a more robust plant than the Mindoro and Luzon form but otherwise presenting no peculiar characters.

3. **ARENGA TREMULA** Becc. in Philip. Journ. Sci. 4 (1909) Bot. 612.

Caryota tremula Blanco Fl. Filip. (1837) 744; Kunth Enum. Pl. 3 (1841) 549.

Didymosperma tremulum Wendl. et Dr. in Kerch. Les Palms (1878) 243.

LUZON, Tayabas Province, *For. Bur. 10213, 10280 Curran,* very common, *Bur. Sci. 1737 McGregor.* PALAWAN, Victoria Peak, *Bur. Sci. 735 Foxworthy;* near Irauan (altitude, 200 meters) *For. Bur. 3542 Curran,* Brooke's Point, *Elmer 12596.* BALABAC, *Merrill 5372.*

4. **ARENGA AMBONG** Becc. in Philip. Journ. Sci. 2 (1907) Bot. 229.

Wallichia oblongifolia (non Griff.) Becc. in Webbia 1 (1905) 328.

MINDANAO, Zamboanga District, *Garcia 653*, *Copeland 1681*, *Merrill 8367*. Moro name *ambong*.

CARYOTA Linnaeus

The genus *Caryota* is represented in the Philippines by few species, which however seem rather variable, and which, so far as I can determine from dry, very often incomplete, herbarium specimens, present, at times, forms with ambiguous or uncertain characters and are therefore difficult to identify.

The doubt is not altogether to be excluded that occasionally some of the ambiguous forms may be of hybrid origin. Two principal species are frequently met with throughout the Philippines, one of which, a large and fine palm, is to be considered, I think, not specifically distinct from the very widely spread and very variable *Caryota Rumphiana;* the other, considerably smaller, is an endemic species, *C. Cumingii*, which at times presents forms not easily distinguishable, at least in the herbarium, from *C. mitis* Lour., a plant common in Cochinchina and in the Malayan region. Specimens of *Caryota mitis*, agreeing in every respect with the Cochinchina plant, have been collected in Palawan; *C. Cumingii*, however, is always solitary, not suboliferous.

Caryota Merrillii and *C. majestica* are species of which I have only an incomplete knowledge; both are apparently related to *C. Cumingii* or perhaps are varieties of that, and properly to be understood they require the examination of more complete material than I have had at my disposal or, better still, an examination of the living plants in their native country. *Caryota Rumphiana* var. *oxyodonta* Becc., collected only once and established on a single incomplete specimen, is another form of which more complete material is desired.

Conspectus of the species.

a^1. Large trees. Stem tall, solitary. Fruit 1- or 2-seeded. Fruiting perianth 10 to 11 mm in diameter. Male flowers large, 15 to 17 mm long, with numerous stamens.

  b^1. Leaflets of the full-grown plant long and narrow, having the upper margin at times very obsoletely, yet at times rather sharply, and very unequally toothed, and the lower margin much produced into a taillike point. Male flowers with 40 to 60 stamens. Stem up to 30 to 40 cm in diameter............ 1. *C. Rumphiana* var. *philippinensis*.

  b^2. Leaflets having the upper margin deeply and acutely toothed, the teeth long, narrow, acuminate, and very close together. Male flowers with 27 to 30 stamens. A smaller plant than var. *philippinensis*. *C. Rumphiana* var. *oxyodonta*.

a^2. Of medium size. Fruit always 1-seeded. Male flowers (where known) small and with few stamens.

  b^1. Stem solitary. Male flowers with 6 to 9 stamens only.

c^{2}. Trunk 5 to 8 m high, 10 to 20 cm in diameter. Leaflets erect-spreading, dimidiate-rhomboidal. Male flowers 6 to 7 mm long, with 9 stamens. Fruiting perianth 6 to 7 mm in diameter. Fruit 12 to 17 mm in diameter, spherical. Seed with a chestnut-brown polished surface. Branches of the spadix strongly hairy-scurfy .... 2. *C. Cumingii.*

c^{3}. Leaflets very spreading or horizontal, frequently opposite, very sharply toothed. Male flowers * * *. Fruit spherical, 12 mm in diameter. Seed nearly spherical, 8 to 9 mm in diameter, with a black, even, and polished surface........................ 3. *C. Merrillii.*

c^{4}. Leaflets ascending, very narrow and very deeply and sharply toothed. Male flowers having 6 stamens only. Fruit 11 to 12 mm in diameter. Seed slightly broader than high, 9 mm broad, of a shiny chestnut-brown color, the surface slightly grooved. 4. *C. majestica.*

b^{2}. Soboliferous or with stems in clusters, about 4 m high and 10 cm in diameter. Male flowers 8 to 12 mm long, with 12 to 16 stamens. Fruit 15 to 16 mm in diameter, frequently broader than high. Fruiting perianth 8.5 to 9 mm in diameter........................ 5. *C. mitis.*

1. CARYOTA RUMPHIANA Mart. var. PHILIPPINENSIS Becc.

Caryota Rumphiana (vix Mart.) Becc. in Perkins Fragm. Fl. Philip. 1 (1904) 48, Webbia 1 (1905) 331.

Caryota urens (non Linn.) Blanco Fl. Filip. (1837) 740 (pro parte).

LUZON, Tayabas Province, *For. Bur. 7850 Curran & Merritt;* Lucban, *Elmer 9301:* Laguna Province, Santa Maria Mavitac, *For. Bur. 10064 Curran;* Mount Maquiling, *For. Bur. 19961 Villamil:* Manila, *Merrill 8037* (cultivated). MINDORO, Bongabong, *Whitford 1373.* MINDANAO, Agusan Province, Mount Urdaneta, *Elmer 13623,* Manobo name *pogahan:* Davao District, Todaya (Mount Apo), *Elmer 10940,* Bagobo name *pola.*

CARYOTA RUMPHIANA Mart. var. OXYODONTA Becc.

LUZON, Laguna Province, Santa Maria Mavitac, *For. Bur. 10045 Curran.*

The specimen of this variety seen by me has dimidiate-rhomboidal leaflets, much more acutely toothed than in the species, the teeth being very close together, very narrow, and very acuminate, and on the average 10 mm long; the lower margin of the leaflets is prolonged into an acuminate, not very long point; the largest leaflets on the sides of the ultimate divisions of the rachis are 18 to 20 cm long and 4 to 5 cm broad; the basal divisions are broader and less acuminate. The floriferous branches are very similar to those of var. *philippinensis* and of the same dimensions. The male flower-buds are globose, 7 mm in diameter with the corolla not yet produced outside the calyx, but even in that condition they show that they would have acquired the dimensions usual to var. *philippinensis.* The stamens are numerous. According to the collector the plant had a trunk 7 m high and 10 cm in diameter, and leaves 2 to 3 m long.

2. **CARYOTA CUMINGII** Lodd. ex Mart. Hist. Nat. Palm. 2:195 (2d ed.); Becc. in Perk. Fragm. Fl. Philip. (1904), Webbia 1 (1905) 331. Curtis's Bot. Mag. III 25 (1869) *t. 6762;* Farnsworth Philip. Bur. Ed. Bull. 54 (1915) 59, with plates.

Caryota urens (non Linn.) Blanco (partly) Fl. Filip. (1837) 740, ed. 2 (1845) 510, ed. 3, 3 (1879) 141 *t. 349.*

Caryota sp. Cuming exsicc. No. 1915; Vidal Phan. Cuming (1885) 153.

LUZON, Manila, *Gaudichaud* in Herb. Delessert, *Merrill 8036,* cultivated: Tayabas Province, *For. Bur. 10348 Curran:* Union Province, Bauang; *Elmer 5647.* MINDORO, *For. Bur. 6216 Merritt,* local name *apican.* PANAY, Miagao, *Vidal 4067* in Herb. Becc. GUIMARAS, *For. Bur. 119 Gamill,* local name *patisan.* MINDANAO, Zamboanga District, Banga, *For. Bur. 9077 Whitford & Hutchinson.* PALAWAN, *Bur. Sci. 873 Foxworthy;* Taytay, *Merrill 9360.*

The Mindanao and Palawan specimens do not seem to be such typical representatives of *Caryota Cumingii* as those from Luzon.

3. **CARYOTA MERRILLII** Becc. in Webbia 1 (1905) 333.

LUZON, Pangasinan Province, Bautista, *Merrill 2880.*

This is known only from the type collection, a rather imperfect specimen; it may perhaps be but a variety of *C. Cumingii.*

4. **CARYOTA MAJESTICA** Lind. Illustr. Hort. 28 (1881) 16 (name only); Becc. in Perk. Fragm. Fl. Philip. (1904) 48, Webbia 1 (1905) 334.

Caryota urens (non Linn.) *foliis angustioribus* Blanco Fl. Filip. (1837) 740.

LUZON, Rizal Province, Bosoboso, *Merrill 1892, Merrill 8490,* local name *anibung.* Perhaps *Vidal 3949* (Herb. Becc.) from Tarlac (sterile specimen) is also referable to this species.

5. **CARYOTA MITIS** Lour. Fl. Cochinch. (1790) 569.

PALAWAN, *For. Bur. 3838, 4148 Curran.*

These specimens are indistinguishable from typical specimens of *C. mitis* collected in Cochinchina; the male flowers are larger than in *C. Cumingii* and with 12 to 18 stamens. I consider also *Elmer 12606* collected at Brooke's Point, Palawan, with the local name *bato* as referable to *C. mitis.* Of this it is noted that the stems are usually 3 to 5 in a cluster, which is one of the essential characteristics of *C. mitis.*

NIPA Rumphius

NIPA FRUCTICANS Wurmb in Verh. Bat. Genootsch. 1 (1779) 349.

LUZON, Cagayan Province, *For. Bur. 17265 Curran.* BILIRAN, *Bur. Sci. 18700 McGregor.* POLILLO, *Bur. Sci. 9061 Robinson, Bur. Sci. 10462 McGregor.* PALAWAN, *Bur. Sci. 273 Bermejos.*

Along tidal streams throughout the Philippines, in places gregarious over very large areas, forming the so-called "nipales" or nipa swamps.

COCOS Linnaeus

COCOS NUCIFERA Linn. Sp. Pl. (1753) 1188.

Cultivated throughout the Philippines both in the coastal region and in the interior in those regions where there is no prolonged dry season.

PHOENIX Linnaeus

PHOENIX HANCEANA Naud. var. **PHILIPPINENSIS** Becc. in Philip. Journ. Sci. 3 (1908) Bot. 339.

BATAN ISLANDS, Sabtan, *Bur. Sci. 3744 Fénix.*

The collector's note gives the diameter of the trunk of this variety as 45 cm, which he afterwards explained was an error for its circumference.

LICUALA Rumphius

LICUALA SPINOSA Wurmb in Verh. Bat. Genootsch. 2 (1780) 469.

PALAWAN, *Merrill 1463*, *Bur. Sci. 836 Foxworthy*, *Bur. Sci. 269 Bermejos.* BALABAC, *Bur. Sci. 448 Mangubat.* CULION, *Merrill 543.*

In thickets at low altitudes, in some regions growing in mud immediately back of the mangrove swamps.

LIVISTONA R. Brown

Conspectus of the species.

a^1. Leaves irregularly parted into primary 2- to 6-costulate segments; secondary segments 1-costulate, very deeply parted into two very long flaccid laciniae. Petiole armed, especially in its lower portion, with very robust spines. Flowers sessile and in small groups on the branchlets. Fruit globose or very slightly reniform, bluish even when dry, 11 to 15 mm in diameter................................ 1. *L. cochinchinensis.*

a^2. Leaves entire in their central part, and with the periphery more or less deeply divided into always unicostulate segments. Flowers solitary, spirally inserted around the branchlets.

  b^1. Flowers relatively large, 4 to 4.5 mm long. Leaves of adult plants having unarmed or, at times, slightly spinose petioles. The dry mature fruit spherical, 22 to 23 mm in diameter, with a very dark brown polished surface. The young fruits are slightly oblong and narrow a little toward the base.. 2. *L. Merrillii.*

  b^2. Flowers very small, at most 2 mm in diameter.

    c^1. Petioles of the adult plant spinose in their basal part, unarmed elsewhere. Spadix composed of three main inflorescences, free from their bases and all issuing from a common flattened spathe; upper spathes very tightly sheathing throughout, truncate at the mouth, and, as are all the other parts of the spadix, reddish-brown when dry. Fruit spherical even when young, dark-violaceous when fresh, quite black when dry........................ 3. *L. rotundifolia.*

    Forma *typica* (not yet found growing in the Philippines) is especially characterized by the seed having the intrusion of the raphe penetrating only two-thirds of the albumen.

d^1. Fruit 2 cm in diameter. Seed traversed completely from base to apex by the intrusion of the raphe. Leaves of very young plants having the petioles armed, in their basal part, with conspicuous spines, as much as 15 to 20 mm in length, the leaves of adult plants with the central segments shortly bifid. *L. rotundifolia* Mart. var. *luzonensis.*

d^2. Fruit 12 to 15 mm in diameter, the kernel alone 10 to 13 mm in diameter. Seed 8 to 10 mm in diameter, more or less traversed by the intrusion of the raphe. Central segments of the adult leaves shortly bifid at their apices. *L. rotundifolia* var. *microcarpa.*

d^3. Fruit of medium size. Central segments of the adult leaves parted into two 15 to 20 cm long laciniae. *L. rotundifolia* var. *mindorensis.*

c^2. Petioles of leaves in the adult plant unarmed, at least in their upper part; in young plants armed with very small spines. The mature fruit yellowish orange when fresh, yellowish brown when dry. Spathes straw-colored, slashed at the mouth. 4. *L. Robinsoniana.*

1. **LIVISTONA COCHINCHINENSIS** Mart. Hist. Nat. Palm. 3 (1838) 319; Hook. f. Fl. Brit. Ind. 6 (1892) 434; Becc. Malesia 3 (1886) 69.

Livistona spectabilis Griff. in Calcutta Journ. Nat. Hist. 5 (1845) 336, Palms Brit. Ind. (1845) 130, *t. 266, C.*

Livistona inaequisecta Becc. in Philip. Journ. Sci. 4 (1909) Bot. 616.

LUZON, Cagayan Province, *For. Bur. 17145, 17302, 17156 Curran,* local name *tarao, For. Bur. 14762 Darling:* Laguna Province, Santa Maria Mavitac, *For. Bur. 10079 Curran;* Cavinti, *Loher 7058.*

2. **LIVISTONA MERRILLII** Becc. in Perk. Fragm. Fl. Philip. (1904) 45, Webbia 1 (1905) 339.

Livistona Whitfordii Becc. in Webbia op. cit. 341, Philip. Journ. Sci. 4 (1909) Bot. 615.

LUZON, Cagayan Province, Mount Narig, *For. Bur. 17811 Curran,* common at 200 meters' altitude, forming small groves in *Shorea* forests, trunk 20 m by 60 cm; *For. Bur. 17278 Curran,* on rocky coral limestone hills near the seashore, altitude 60 meters, locally known as *ballang,* the leaves used for thatching houses and for raincoats, the stems for bows and for flooring: Tayabas Province, Guinayangan, *Merrill 2071* (type), *For. Bur. 10189 Curran;* Atimonan, *Whitford 731* (type of *L. Whitfordii* Becc.): Zambales Province, *For. Bur. 5876 Curran,* locally known as *telsis.*

3. **LIVISTONA ROTUNDIFOLIA** Mart var. **LUZONENSIS** Becc.

Livistona rotundifolia (vix Mart.) Becc. in Leafl. Philip. Bot. 2 (1909) 647.

LUZON, Zambales Province, *For. Bur. 5834 Curran:* Albay Province, *For. Bur. 15322 Aguilar,* local name *anahao* or *bulus:* Tayabas Province, Lucban, *Elmer 9293* (in flower): Union Province, Castillo (specimen with mature fruits), *Loher 7070* in Herb. Kew.: Benguet Subprovince, Sablan, *Bur. Sci. 12687 Fénix* (leaves from a young plant), *Merrill 8799.*[1]

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[1] For the uses of the anahao palm see Philip. Bur. Ed. Bull. 54 (1917) 68, 69, *plates.*

LIVISTONA ROTUNDIFOLIA Mart. var. **MICROCARPA** Becc.

Livistona microcarpa Becc. in Philip. Journ. Sci. 2 (1907) Bot. 231.

PALAWAN, Caranugan River, *For. Bur. 3784 Curran*, in river swamps. MINDANAO, Davao District, a few miles west of Digas at Todaya (Mount Apo), *Elmer 11967*, local name *balla.*

LIVISTONA ROTUNDIFOLIA Mart. var. **MINDORENSIS** Becc.

Livistona mindorensis Becc. in Philip. Journ. Sci. 4 (1909) Bot. 615.

MINDORO, Bongabong River, *For. Bur. 4108 Merritt*, very common, Tagalog name *panobao.*

4. **LIVISTONA ROBINSONIANA** Becc. in Philip. Journ. Sci. 6 (1911) Bot. 230.

POLILLO, *Bur. Sci. 9265 Robinson, Bur. Sci 10471 McGregor*, Tagalog *pilig.* LUZON, Laguna Province, Cavinti, *Loher 7056*, in Herb. Kew.

CORYPHA Linnaeus

CORYPHA ELATA Roxb. Fl. Ind. ed. 2, 2 (1832) 176; Griff. Palms Brit. Ind. (1845) 112, *t. 220 D.*

Corypha Gebanga Bl. Rumphia 2 (1836) 59, *t. 97, 98 et 105.*
Livistona Vidalii Becc. in Webbia 1 (1905) 343.
Corypha umbraculifera (non Linn.) Vidal Sinopsis Atlas (1883) 91, *t. 93;* F.-Vill. Novis. App. (1883) 281, incl. var. *cubang* and *sylvestris.*

LUZON, Pangasinan Province (cultivated), *For. Bur. 8410 Curran & Merritt;* Union Province, Naguilian, *Bur. Sci. 18000 Fénix:* Tayabas Province, Lucban, *Elmer 9294:* Pampanga Province, Arayat, *Garcia 63* (leaf from a very young plant, the type of *Livistona Vidalii* Becc.). SIBUYAN, Mount Giting-Giting, *Elmer 12567.* MINDORO, Bongabong River, *For. Bur. 4121 Merritt.* MINDANAO, *Elmer 11965*, with the local name *serrar.*

This species is the buri palm. Leaf strips from it are used in the Philippines for making different sorts of hats[3] and other valuable commercial materials.[4]

The specimens from Mindoro have floriferous branchlets larger than usual, as much as 40 cm in length.

Corypha elata Roxb. is distinguishable from the allied species by the trunk, which in the full-grown plant is very high and relatively slender and is marked all around by a slightly depressed spiral trace of the insertion of the fallen leaves; it is also characterized by its pyramidate inflorescence representing from one-fourth to one-fifth of the entire plant, and by its globular fruit, 20 to 23 mm in diameter, born on pedicels 3 to 5 mm long.

Specimens of *Corypha* collected on Biliran Island by *McGregor* in June, 1914, *Bur. Sci. 18720*, have a secondary branch of the inflorescence divided into several very short (3 to 5 cm long) fructiferous branchlets, and the fruits are smaller than usual (16 to 18 mm in diameter, the seed 12 mm in diameter). I do not know if this specimen is to be considered an abnormal one, or if it represents a constant characteristic; in the latter case it ought to be considered as a species distinct from *Corypha elata*.

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[3] See Robinson, C. B., Philippine hats in *Philip. Journ. Sci.* 6 (1911) *Bot.* 106, 113, *t. 7, 8.*

[4] See Farnsworth, C. G., Philip. Bur. Ed. Bull. 54 (1915) 62, 63, *plates.*

METROXYLON Rottboell

METROXYLON RUMPHII Mart. Hist. Nat. Palm. 3 (1838) 214, 313, *t. 102, 159;* Becc. in Ann. Bot. Gard. Calcutta 12^2: *t. 105.*

MINDANAO, Davao District, Todaya, *Elmer 11160,* local name *lumbia:* Surigao Province, Catel, *Merrill 5443.*

ZALACCA Reinwardt

ZALACCA CLEMENSIANA Becc. in Philip. Journ. Sci. 4 (1909) Bot. 618, Ann. Bot. Gard. Calcutta 12^2: *t. 49.*

MINDANAO, Lanao District, Camp Keithley, *Mrs. Clemens 1109;* Davao District, Todaya, *Elmer 11879,* local name *lacaubi.*

PLECTOCOMIA Martius et Blume

PLECTOCOMIA ELMERII Becc. in Ann. Bot. Gard. Calcutta 12^2: *t. 22.*

MINDANAO, Davao District, Todaya, *Elmer 11887.*

KORTHALSIA Blume

Conspectus of the species.

a^1. Spikes amentiform with very closely crowded flowers and appressed spathels.
  b^1. Leaf-sheaths produced at the base of the petioles into an inflated elongate-elliptic ocrea; leaflets more or less nearly white underneath .... 1. *K. scaphigeroides.*
  b^2. Leaf-sheaths produced at the bases of the petioles into a closely sheathing, densely spinous ocrea.
    c^1. Slender; leaflets of the upper part of the fertile plant small, rhomboidal, green on both surfaces or slightly paler beneath than above .... 2. *K. Merrillii.*
    c^2. Robust; leaflets large, cuneate-rhomboidal or trapezoidal, sharply double-toothed, paler beneath than above .... 3. *K. laciniosa.*
a^2. Spikes of squarrose appearance, the spathes scarious and not appressed; leaves furnished with an elongate, cornet-shaped ocrea which is truncate at the apex; leaflets cuneately rhomboidal, white underneath .... 4. *K. squarrosa.*

1. **KORTHALSIA SCAPHIGEROIDES** Becc. in Philip. Journ. Sci. 4 (1909) Bot. 619, Ann. Bot. Gard. Calcutta 12^2: *t. 67.*

MINDANAO, Zamboanga District, *For. Bur. 4816 Hutchinson:* Butuan Subprovince, Agusan River, *Merrill 7313.* BASILAN, *For. Bur. 6106 Hutchinson.*

2. **KORTHALSIA MERRILLII** Becc. in Ann. Bot. Gard. Calcutta 12^2: *t. 81.*

PALAWAN, Malampaya Bay, *Merrill 9410.*

3. **KORTHALSIA LACINIOSA** Mart. Hist. Nat. Palm. 3 (1838) 211, 343.
Korthalsia sp., *Vidal No. 4066;* Becc. in Philip. Journn. Sci. 4 (1909) Bot. 621.

LUZON, Sorsogon Province, Mount Bulusan, *Elmer 16672*, July, 1916, in flower. Vidal's sterile specimen (*4066*), also from Sorsogon, is doubtless this species, to which is also referable another sterile specimen collected at Laguimanoc, Tayabas Province, Luzon, by *Klemme*, November, 1904. Local name *daanan* (which is also the Malay name for several species of *Korthalsia*). Possibly to *Korthalsia laciniosa* Mart. also belongs a sterile specimen collected in Polillo, *Bur. Sci. 10464 McGregor.*

4. **KORTHALSIA SQUARROSA** Becc. in Philip. Journ. Sci. 4 (1909) Bot. 620, Ann. Bot. Gard. Calcutta 12²: *t. 103.*

PALAWAN, near Iwahig, *For. Bur. 4185 Curran.* BALABAC, *Merrill 5384.*

CALAMUS Linnaeus

Conspectus of the species.

a^1. Leaves noncirriferous (the rachis not prolonged into a filiform, clawed or aculeate appendix).

b^1. Female flowers and fruits sessile or nearly so; that is, not furnished with a distinct pedicel derived from the lengthened involucrophore.

c^1. Leaflets almost equally green on both surfaces.

d^1. Leaflets narrow, linear or linear-lanceolate, 1- to 3-costulate.

e^1. Spadices shortly flagelliferous, about as long as the leaves; fruits small, ovoid; seeds with equable albumen.

f^1. Leaf-sheaths armed with slender straight spines; primary spathes also spinulous; leaflets very numerous; spathels of the female spikelets very short, bracteiform. A very variable plant, of which it is difficult to establish well-defined varieties, as one merges into the other by intermediate forms .... 1. *C. mollis.*

g^1. Sheathed stem usually 15 to 20 mm in diameter; leaf-sheaths more or less densely spinous; leaves 50 to 80 cm long .... *C. mollis* (forma *typica*).

g^2. Robust; sheathed stem 2.5 to 3 cm in diameter; leaves up to 1.2 m long .... *C. mollis* var. *major.*

g^3. Slender; sheathed stem 12 to 15 mm in diameter; leaf-sheaths almost spineless .... *C. mollis* var. *palawanensis.*

f^2. Leaf-sheaths and spathes unarmed; leaflets numerous; spathels of the female spikelets very short, bracteiform.
2. *C. meyenianus.*

f^3. Very slender; leaflets very few and very inequidistant; spathels of the female spikelets shortly infundibuliform.
3. *C. Blancoi.*

e^2. Spadices (male and female) extremely long, and flagelliform, considerably longer than the leaves.

f^1. Leaflets sparingly spinulous on three nerves above, the midrib alone minutely hairy-spinulous underneath; female spadix with thickish spikelets drawn together around the main axis; fruit nearly spherical (13 to 14 by 10 mm), with a broad, blunt, black beak; seed pitted-ruminate.
4. *C. melanorhynchus.*

f^1. Leaflets having three slightly bristly nerves on the upper surface and covered throughout on the lower surface with numerous fulvous bristles; female spadix with slender, very spreading spikelets; fruit small, globose-ovoid (11 to 12.5 by 7 mm), with a narrow beak; seed pitted-ruminate. 5. *C. filispadix.*

f^2. Leaflets with two bristly lateral nerves and the midrib smooth on the upper surface, the midrib bristly and the lateral nerves smooth underneath; spadices very loosely branched; male spikelets short, comblike; fruit spherical, 15 to 16 mm in diameter; seed very deeply ruminate throughout .... 6. *C. Diepenhorstii* var. *exulans.*

d^2. Leaflets lanceolate, 5-costulate; very robust; leaflets large, equidistant; fruit large, ellipsoid, 3.5 cm long, 2.3 mm thick; seed quadrangular .... 7. *C. ornatus* var. *philippinensis.*

c^2. Leaflets conspicuously discolorous, green above, white underneath; leaf-sheaths flagelliferous; spadix flagelliferous at its apex; primary spathes much lacerated in their upper part.

d^1. Leaflets bristly on three nerves above and on the midrib alone beneath .... 8. *C. discolor.*

d^2. Leaflets without bristles or nearly so on the upper surface, densely sprinkled with numerous subspiny bristles beneath. *C. discolor* var. *negrosensis.*

b^2. Female flowers supported by a distinct pedicel derived from the elongation of the involucrophore; leaves of the upper part of the plant having the apices with gradually diminishing, pluricostulate leaflets, and the rachis clawed and subcirriferous.

c^1. Leaflets distinctly grouped, broadly oblanceolate and suddenly apiculate, slightly paler below than above; spikelets branched; fruit pisiform .... 9. *C. Cumingianus.*

c^2. Leaflets not grouped, lanceolate, gradually acuminate, more or less covered underneath with a very thin, adherent, ochraceous coating; spikelets simple, elongate; fruit pisiform........ 10. *C. simphysipus.*

a^2. Leaves having the rachis prolonged into a clawed cirrus.

b^1. Male and female spadices having the spikelets provided with a very distinct pedicellar part which is inserted at the bottom of the spathes.

c^1. Very robust; leaf-sheaths covered with slender spiculae, the latter individually distinct or more or less confluent by their broadened bases; leaflets more or less furnished with long bristles, especially on the midrib underneath; secondary spathes coriaceous, entire; fruit spherical, 10 to 12 mm in diameter; secondary spathes smooth.. 11. *C. Merrillii* (forma *typica*).

d^1. Secondary spathes prickly................ *C. Merrillii* var. *Merrittianus.*

d^2. Secondary spathes smooth or nearly so; a smaller plant and with slenderer spikelets than in the species, the fruit also smaller (9 mm in diameter)................ *C. Merrillii* var. *Nanga.*

c^2. Moderately large; leaf-sheaths very densely covered with blackish uniform bristles; leaflets with long bristles on three costae on both surfaces; fruit spherical, 10 to 12 mm in diameter. 12. *C. Foxworthyi.*

b^2. Male and female spadices having sessile spikelets inserted at or near the mouths of their respective spathes.

c^1. Primary spathes elongate and closely sheathing.

d^1. Fruit containing three seeds.

e^1. Robust; leaflets large, subequidistant, lanceolate, long-acuminate, plicate-pluricostulate; spikelets thickish, as much as 15 to 16 cm long; fruit spherical, 14 to 17 mm in diameter. 13. *C. manillensis.*

e^2. A smaller plant; leaflets broadly lanceolate, shortly acuminate, subequidistant in the full-grown plant, in pairs on each side of the rachis in young plants; fruit obovoid, conspicuously beaked .... 14. *C. trispermus.*

d^2. Fruit 1-seeded.

e^1. Leaflets equidistant or nearly so.

f^1. Leaflets broadly lanceolate, pluricostulate.

g^1. Two female flowers at every spathel with a neuter one interposed between the two.

h^1. Female spadix very dense and with short branches; spikelets short and with few flowers; female flowers relatively large, 6 mm long; immature fruits fusiform; fruiting perianth campanulate .... 15. *C. Arugda.*

h^2. Female spadix very diffusely branched; spikelets elongate and with numerous flowers; fruit globose-ovoid; fruiting perianth shortly pedicelliform........ 16. *C. vinosus.*

g^2. One female flower only at each spathel, with a neuter flower at its side.

h^1. Fruit small, pisiform; seed pitted, the albumen equable or nearly so.

i^1. Leaflets narrowly elliptic-lanceolate, equally narrowed at both ends, more or less spinulose on some nerves above, smooth underneath; fruit 8 to 9 mm in diameter, having squarrose scales in twelve longitudinal series .... 17. *C. Moseleyanus.*

i^2. Leaflets lanceolate, acuminate, more or less spinulous on some nerves above, smooth underneath; fruit 6.5 mm in diameter, having appressed scales in 18 to 20 longitudinal series .... 18. *C. mindorensis.*

i^3. Leaflets lanceolate, very long-acuminate without bristles or spines on either surface; fruit globose-ovoid, 6 mm in diameter, shortly conical-ovoid, and having squarrose scales; leaf-sheaths quite unarmed. 19. *C. multinervis.*

h^2. Fruit rather large; seed with a deeply ruminated albumen.

i^1. Leaflets large, broadly lanceolate, 40 to 42 cm long, 4 to 4.5 cm wide, pluricostulate and with the nerves smooth on both surfaces; fruit spherical, 2 cm in diameter .... 20. *C. grandifolius.*

i^2. Leaflets 5-costulate, elliptic-lanceolate, 22 to 25 cm long, 30 to 32 mm wide, with the nerves smooth on both surfaces; fruit ovoid-ellipsoid, conspicuously beaked, 25 mm long, 18 mm thick. 21. *C. Jenningsianus.*

f^2. Leaflets very narrowly lanceolate, 3-costulate; leaflets more or less bristly-spinulous on three nerves above and smooth underneath; fructiferous spikelets curved-scorpioid; fruit spherical, shortly and obtusely beaked, 12 to 13 mm in diameter; albumen deeply ruminated; leaf-sheaths armed with scattered spines .... 22. *C. Samian.*

e^2. Leaflets conspicuously inequidistant.

f^1. Leaflets more or less distinctly geminate on each side of the rachis, 5-pluricostulate, oblong or lanceolate, the leaflets of each pair parallel, that is, not approximate by their bases and not divaricating; fruiting perianth pedicelliform, the fruit itself furnished with a short, pedicelliform or necklike involucrophore.

g^1. Robust; leaflets very large, pluricostulate oblong-spathulate with smooth nerves on both surfaces; 35 to 45 cm long, 6 to 10 cm wide; fruit spherical, 13 mm in diameter; leaf-sheaths unarmed .... 23. *C. megaphyllus.*

g^2. Rather slender; leaf-sheaths armed with slender spines; leaflets elliptic-lanceolate or oblanceolate, 15 to 25 cm long, 3 to 6.5 cm wide, with five slender costae almost smooth on both surfaces .... 24. *C. Elmerianus.*

g^3. Slender; leaf-sheaths unarmed; leaflets oblanceolate-elliptic or oblong-spathulate, 20 to 24 cm long, 5 to 6.5 cm wide, smooth on both surfaces; fruit globose, 9 to 10 mm in diameter .... 25. *C. mitis.*

f^2. Leaflets 5-costulate, those of each pair very approximate by their bases and divaricate; female spikelets having the involucrophorum (where known) not the least pedicelliform or necklike, but immersed within its spathel.

g^1. Of medium size; leaf-sheaths strongly spinous; leaflets elliptic-lanceolate, 22 to 25 cm long, 6 to 6.5 cm wide, very frequently furnished with one or two rigid spines on the midrib above near the base, otherwise smooth on both surfaces; fruiting perianth obconical, almost spreading .... 26. *C. Reyesianus.*

g^2. Slender; leaf-sheaths smooth or very sparingly spinulous; leaflets elliptic-lanceolate, 10 to 16 cm long, 2 to 3.5 cm wide, usually furnished with a few erect needlelike spines on some of the five costae on the upper surface and on the margins or else entirely smooth; fruiting perianth almost explanate; fruit spherical, 10 to 11 mm in diameter .... 27. *C. spinifolius.*

g^3. Leaf-sheaths 2.5 cm in diameter, armed with short spines; leaflets deep green and smooth when dry, almost equally shiny on both surfaces, lanceolate-elliptic, quite devoid of hairs or spinules even at the apex and on the margins, occasionally furnished above with a robust spinule on the midrib near the base; male spikelets flattened-pectinate, with contiguous flowers and very approximate bracteiform spathels.............................. 28. *C. viridissimus.*

f^3. Leaflets in distant groups; the latter composed of more than two leaflets on each side of the rachis; leaf-rachis smooth.

g^1. Slender; leaf-rachis smooth above; leaflets in groups of 2 to 4 on each side of the rachis, lanceolate, very long-acuminate to a filiform tip, 3- sub 5-costulate, 20 to 30 cm long, 15 to 20 cm wide; female spadix very diffusely paniculate; spikelets filiform; fruit very small, spherical, 5 mm in diameter............ 29. *C. microsphaerion.*

h^1. Leaf-sheaths unarmed; leaflets glabrous on both surfaces. *C. microsphaerion* (forma *typica*).

h^2. Leaf-sheaths strongly armed with short spines; leaflets slightly bristly-spinulous on one to three nerves on the upper surface...... *C. microsphaerion* var. *spinosior.*

g^2. Rather slender; leaflets in distant groups of 3 to 9 on each side of the rachis, linear, 1-, sub 3-costulate, smooth on both surfaces, 20 to 25 cm long, 1 cm wide; female spadix very diffuse and much branched; spikelets filiform; fruiting perianth shortly pedicelliform; fruit very small, globose.. 30. *C. ramulosus.*

f^4. Leaflets very inequidistant, yet not distinctly grouped on each side of the rachis, the latter strongly prickly above, at least in its lower portion; leaflets elongate, linear-lanceolate, rigid, 3-costulate, more or less spinuliferous on the upper surface, smooth underneath, 30 to 32 cm long, 20 to 25 mm wide; leaf-sheaths about 2 cm in diameter, armed with scattered, pale, acicular spines; male and female spadices shorter than the leaves, simply and spreadingly branched.. 31. *C. Vidalianus.*

c^2. Primary spathes very loosely sheathing, usually short, and more or less inflated in their upper part. The species of this group are difficult to discriminate if the specimens are not with mature fruits; the male spadices alone do not offer appreciable characters for specific distinction.

d^1. Fruit very small, having convex scales, the latter only slightly or not at all grooved along the center and with the points not appressed or subsquarrose.

e^1. Leaf-sheaths armed with scattered slender spines or almost smooth; fruiting perianth pedicelliform, terete.

f^1. Leaf-sheaths armed with scattered slender spines; primary spathes aculeolate; fruit ovoid or subobovoid, 6 mm long, 3.5 to 4 mm thick, the scales arranged in fifteen longitudinal series............ 32. *C. siphonospathus* (forma *typica*).

f^2. Leaf-sheaths almost spineless; primary spathes smooth; fruit with scales arranged in fifteen longitudinal series. *C, siphonosphathus* var. *sublaevis.*

f^3. Fruit with scales in twelve longitudinal series; leaflets with five bristly nerves on the upper surface. *C. siphonospathus* var. *oligolepis major.*

f^4. Smaller; fruit with scales in twelve longitudinal series; leaflets with three bristly nerves on the upper surface. *C. siphonospathus* var. *oligolepis minor.*

f^5. Primary spathes aculeolate; fruit with scales in eighteen longitudinal series............ *C. siphonospathus* var. *polylepis.*

f^6. Primary spathes very slightly inflated; fruit elongate-ellip-

soid, 10 to 11 mm long (including the perianth), 5 mm thick; scales in fourteen or fifteen longitudinal series.
C. siphonospathus var. *batanensis*.

e^{2}. Leaf-sheaths very densely armed, at least in their upper part, with ascending unequal spines.

f^{1}. Leaf-sheaths armed with elongate, ascending, very narrowly laminar spines; the elongate ligula densely armed with similar spines; petiole and rachis armed irregularly with unequal spines; leaflets with rigid bristles on the midrib alone above, smooth underneath; margins conspicuously spinulous-ciliate; fruit small, ovoid-ellipsoid, 8 to 9 mm long, 5 mm thick; fruiting perianth campanulate, subpedicelliform........ 33. *C. dimorphacanthus* (forma *typica*).

g^{1}. Leaf-sheaths armed with unequal long spines, some of which are very slender and criniform, others laminar; the very elongate ocrea is also armed with similar spines; leaflets with rigid bristles on three nerves above and smooth underneath; margins closely and finely ciliate-spinulous.
C. dimorphacanthus var. *montalbanicus*.

g^{2}. Leaf-sheaths very densely armed, in their upper part mostly, with very rigid subcriniform spines; leaflets very rigid, furnished on the upper surface with distant coarse bristles on the midrib alone, the lower surface smooth, margins coarsely spinulous; fruit larger than in the species, globose, 13 mm long, 10 mm thick; supported by the short terete pedicelliform perianth.
C. dimorphacanthus var. *zambalensis*.

d^{2}. Fruit covered by strongly gibbous scales, very deeply grooved along the center, and with very appressed points.

e^{1}. Fruit ovoid or subglobose-ovoid, 8 to 12 mm long, including the short, terete, supporting perianth, and 5 to 8 mm thick, obtusely beaked.

f^{1}. Leaflets numerous, elongate, 10 to 15 mm wide; leaves with subequidistant leaflets, at least in their lower part, and more or less grooved above.
34. *C. microcarpus* (forma *typica*).

f^{2}. Very slender; leaflets very narrow, not numerous, and very inequidistant; spadix small..*C. microcarpus* var. *diminutus*.

e^{2}. Fruit ovoid or subovoid, minutely beaked, 17 mm long, including the short, terete, pedicelliform perianth, and 12 mm through .... 35. *C. halconensis*.

c^{3}. The primary spathes at first enveloping the partial inflorescences, then splitting longitudinally and opening flat, becoming laminar and finally falling in decay; leaflets conspicuously discolorous, green above and with a chalky coating underneath; fruit small, ovoid or globose-ovoid, 8 to 9 mm long, including the short, terete, pedicelliform perianth, and 5 mm thick .... 36. *C. bicolor*.

1. **CALAMUS MOLLIS** Blanco Fl. Filip. (1837) 264; ed. 2 (1845) 184; ed. 3, 1 (1877) 329; Kunth Enum. Pl. 3 (1841) 594; Mart. Hist. Nat. Palm. 3 (1838) 336; Walp. Ann. 3 (1853) 486, 5 (1858) 831;

Miq. Fl. Ind. Bat. 3 (1855) 123; Becc. in Rec. Bot. Surv. Ind. 2 (1902) 204, Perk. Fragm. Fl. Philip. 1 (1904) 46, Webbia 1 (1905) 345, Philip. Journ. Sci. 3 (1908) Bot. 342, Ann. Bot. Gard. Calcutta 11 (1908) 212, *t. 61, 62* and Suppl. 21; C. B. Robinson in Philip. Journ. Sci. 6 (1911) 117; Farnsworth Philip. Bur. Ed. Bull. 54 (1915) 19; 72–73 with fig.

Calamus Haenkeanus Mart. l. c. 3: 212 (1st ed.) and 337; Kunth Enum. Plant 3 (1841) 211; Walpers Ann. 3 (1852) 488, 5 (1858) 831; Miq. Fl. Ind. Bat. 3 (1855) 127.

Calamus usitatus (not of Blanco) Mart. op. cit. 340; Vidal Sinopsis Atlas (1883) *t. 93, f. D.*

Calamus sp. Cuming No. 1478; Vidal Phan. Cuming Philip. (1885) 154.

LUZON, Camarines Province, *Cuming 1478:* "Manilla," *Gaudichaud* in Herb. Deless.: Rizal Province (Morong) *Vidal 1939*, Herb. Kew.; Bosoboso, *Loher 1372, 1367*, Herb. Kew., *Bur. Sci. 381 Ramos;* Montalban, *Loher 7081*, Herb. Kew.; Antipolo, *For. Bur. 389 Ahern's collector:* Bataan Province, Mount Mariveles, *Warburg 12506*, Herb. Berol., *For. Bur. 6372 Curran, For. Bur. 3026 Borden, For. Bur. 2481 Barnes:* Bulacan Province, Baliuag, *Bur. Sci. 9571 Robinson:* Nueva Ecija Province, *For. Bur. 8484 Curran:* Ilocos Norte Province, *Bur. Sci. 7723 Ramos:* Bontoc Subprovince, *For. Bur. 17034 Curran:* Nueva Vizcaya Province, Dupax, *Bur. Sci. 11218, 11322 McGregor:* Cagayan Province, *For. Bur. 17273 Curran*, local name *barit.* BABUYAN ISLANDS, Camiguin, *Bur. Sci. 4032 Fénix.* BILIRAN, *Bur. Sci. 18634 McGregor.* MINDANAO, Surigao Province, *Bolster 347:* Zamboanga District, *For. Bur. 4819 Hutchinson:* Davao District, Todaya, Mount Apo, *Elmer 11969*, local name *arit.*

CALAMUS MOLLIS Blanco var. **MAJOR** Becc. in Webbia 1 (1905) 345, Ann. Bot. Gard. Calcutta 11: Suppl. 23; Merr. in Philip. Journ. Sci. 1 (1906) Suppl. 31.

LUZON, Bataan Province, Lamao River, Mount Mariveles, *For. Bur. 2499 Meyer*, local name *uay.*

CALAMUS MOLLIS Blanco var. **PALAWANICUS** Becc. in Philip. Journ. Sci. 2 (1907) Bot. Gard. Calcutta 11: Suppl. 22.

PALAWAN, *For. Bur. 3613 Curran, Bur. Sci. 609 Foxworthy;* Puerto Princesa, *Bur. Sci. 191, 196 Bermejos;* Brooke's Point, *Elmer 12607.*

Barely distinguishable from the type; the leaflets, however, are frequently almost equidistant.

2. **CALAMUS MEYENIANUS** Schauer in Nova Acta Acad. Caes. Nat. Cur. 19 (1843) Suppl. 1: 425; Becc. in Rec. Bot. Surv. Ind. 2 (1902) 217, Ann. Bot. Gard. Calcutta 11 (1908) 213, *t. 63.*

LUZON, Pangasinan Province, near the village of San Mateo on Mount Masiquie, *Callery* in Herb. Paris; Umingan, *Bur. Sci. 17755 Otanes:* Nueva Vizcaya Province, vicinity of Dupax, *Bur. Sci. 11442 McGregor.*

3. **CALAMUS BLANCOI** Kunth Enum. Pl. 3 (1841) 595; Mart. Hist. Nat. Palm. 3 (1849) 343; Walpers, Ann. 3 (1853) 492, 5 (1858) 832; Miq. Fl. Ind. Bat. 3 (1855) 139; Becc. in Rec. Bot. Surv. Ind. 2 (1902) 204.

Calamus gracilis (not of Roxb.) Blanco Fl. Filip. (1837) 267, ed. 2 (1845) 186, ed. 3, 1 (1877) 332.

Calamus brevifrons Mart. op. cit. 3: 338; Miq. op. cit. 127.

Calamus parvifolius Vidal Phan. Cuming. Philip. (1885) 154, non Roxb.

LUZON, Albay Province, *Cuming 1225:* Bataan Province, Mount Mariveles, *Loher 1376:* Zambales Province, *For. Bur. 387 Maule.* LEYTE, Palo, *Elmer 7282.*

4. **CALAMUS MELANORHYNCHUS** Becc. in Ann. Bot. Gard. Calcutta 11: Suppl. 30, *t. 16.*

MINDANAO, Davao District, Mount Apo, *Elmer 11708.*

5. **CALAMUS FILISPADIX** Becc. in Philip. Journ. Sci. 6 (1911) Bot. 230, Ann. Bot. Gard. Calcutta 11 (1908) Suppl. 28, *t. 15.*

Calamus Hookerianus Becc. in Philip. Journ. 5 (1909) Bot. 621 (non in Ann. Bot. Gard. Calcutta 11: 226).

LUZON, Albay Province, Adlumay Hills, *For. Bur. 10630 Curran* (with young fruits; type specimen): Tayabas Province, Kabibihan, *Bur. Sci. 13128 Foxworthy & Ramos* (♀ specimen in flower); Rizal Province, Montalban, *Loher 7084* in Herb. Kew. (this specimen was erroneously mentioned by me under *C. Diepenhorstii* var. *exulans* Becc. in Ann. Bot. Gard. Calcutta, Suppl. 51). POLILLO, *Bur. Sci. 10467 McGregor.* PALAWAN, Puerto Princesa, *Elmer 12769;* Taytay, *Merrill 7251* (sterile specimen) (the Palawan plant perhaps represents a distinct variety). MINDANAO, Agusan Province, Mount Urdaneta, *Elmer 13949* (perhaps representing a distinct variety).

6. **CALAMUS DIEPENHORSTII** Miq. var. **EXULANS** Becc. in Philip. Journ. Sci. 5 (1909) Bot. 627, 6 (1911) Bot. 230, Ann. Bot. Gard. Calcutta 11: Suppl. 51 (excl. *Loher 7054*).

PALAWAN, Taytay, *Merrill 9357;* Mount Victoria, *Bur. Sci. 756 Foxworthy.* POLILLO, *Bur. Sci. 9111 Robinson.*

7. **CALAMUS ORNATUS** Blume var. **PHILIPPINENSIS** Becc. in Ann. Bot. Gard. Calcutta 11 (1908) 370.

Calamus maximus Blanco Fl. Filip. ed. 1 (1837) 265, ed. 2 (1845) 185, ed. 3, 1 (1877) 331; Kunth Enum. 3 (1841) 595; Mart. Hist. Nat. Palm. 3 (1849) 343; Walp. Ann. 3 (1853) 492, 5 (1858) 832; Miq. Fl. Ind. Bat. 3 (1855) 138.

LUZON, without definite locality, *Loher 1387* Herb. Kew.: Bataan Province, Mount Mariveles, *Whitford 343, 502, For. Bur. 212 Barnes, For. Bur. 2489 Borden:* Tayabas Province, Lucban, *Elmer 7625;* Unisan, *Reyes:* Laguna Province, San Antonio, *Bur. Sci. 16619 Ramos:* Cagayan Province, *For. Bur. 17252 Curran* (♂ flowers): Rizal Province, Montalban, *Loher* in Herb. Kew., Tagalog name *limuran* or *alimoran.* MINDORO, Bongabong River, *For. Bur. 3911, 3913 Merritt.* NEGROS, *For. Bur. 6089 Everett.* BASILAN, *For. Bur. 6107 Hutchinson.* POLILLO, *Bur. Sci. 9266 Robinson, Bur. Sci. 10461 McGregor,* Tagalog name *limuran.* MINDANAO, Davao District, Mount Apo, *Elmer 11286.*

8. **CALAMUS DISCOLOR** Mart. Hist. Nat. Palm. 3: 212 (1st ed.) and 341; Kunth Enum. Pl. 3 (1841) 212; Walp. Ann. 3 (1853) 491, 5 (1858) 832; Miq. Fl. Ind. Bat. 3 (1855) 136; Becc. in Ann. Bot.

Gard. Calcutta 11 (1908) 495, *t. 228,* and Suppl. 125, *t. 71,* Leafl. Philip. Bot. 2 (1909) 649.

Calamus Lindenii Rodigas Illustr. Hort. 30 (1883) 157, *t. 489;* Ridley in Journ. Str. Branch Roy. As. Soc. 44 (1905) 200.

LUZON, Tayabas Province, Lucban, *Elmer 9299:* Laguna Province, San Antonio, *Bur. Sci. 12035 Ramos,* Tagalog *hamlis.*

CALAMUS DISCOLOR Rodigas var. **NEGROSENSIS** Becc. in Philip. Journ. Sci. 4 (1909) Bot. 635, Ann. Bot. Gard. Calcutta 11: Suppl. *t. 72.*

NEGROS, Cadiz, *For. Bur. 12432 Danao, For. Bur. 20893 Tamesis.*

9. **CALAMUS CUMINGIANUS** Becc. in Record Bot. Surv. Ind. 2 (1902) 210, Ann. Bot. Gard. Calcutta 11 (1908) 348, *t. 142.*

Calamus sp. Vidal Phan. Cuming. Philip. (1885) 18, 154.

LUZON, Tayabas Province, *Cuming 762* in Herb. Kew.

To this species apparently also belongs *Elmer 13646,* collected at Cabadbaran, Mount Urdaneta, Agusan Province, Mindanao.

10. **CALAMUS SIMPHYSIPUS** Mart. Hist. Nat. Palm. 3: *t. Z, 8, f. 14;* Becc. in Ann. Bot. Gard. Calcutta 11 (1908) 346, *t. 141.*

MINDANAO, Agusan Province, Cabadbaran (Mount Urdaneta), along Cantagan Creek at about 900 meters' altitude, *Elmer 13902,* Manobo name *balanog.*

11. **CALAMUS MERRILLII** Becc. Ann. Bot. Gard. Calcutta 11 (1908) 390, *t. 167,* and Suppl. 78, *t. 41,* Webbia 1 (1905) 347, Philip. Journ. Sci. 4 (1909) Bot. 629.

Calamus maximus (not of Blanco) Becc. in Perk. Fragm. Fl. Philip. (1904) 45.

LUZON, Rizal Province, Bosoboso, *Merrill 1893* (type specimen); Mount Matulid (1,200 meters' altitude), *Loher 7074* in Herb. Kew. (male specimen); Montalban, *Loher 7076* in Herb. Kew. (fruit): Laguna Province, *For. Bur. 20654 Villamil.* MINDANAO, Lake Lanao, Camp Keithley, *Mrs. Clemens 1112, 1124:* Agusan Province, Cabadbaran, Mount Urdaneta, *Elmer 13926,* Manobo name *palasan:* Davao District, Todaya, Mount Apo, *Elmer 11885,* Bagobo name *acab-acab.*

The specimens from Mindanao represent a transition to var. *Merrittianus.* Apparently it grows also in Basilan Island, judging from a sterile specimen collected by *Hutchinson, For. Bur. 6098.*

CALAMUS MERRILLII Becc. var. **NANGA** Becc. in Ann. Bot. Gard. Calcutta 11: Suppl. 79.

MINDANAO, Davao District, Mount Apo, *Elmer 11874, 11110.*

CALAMUS MERRILLII Becc. var. **MERRITTIANUS** Becc. in Ann. Bot. Gard. Calcutta 11: Suppl. 78 *t. 42.*

Calamus Merrittianus Becc. in Philip. Journ. Sci. 2 (1907) Bot. 233, 4 (1909) Bot. 629.

MINDORO, Bongabong River, *For. Bur. 3912 Merritt.*

12. **CALAMUS FOXWORTHYI** Becc. in Ann. Bot. Gard. Calcutta 11: Suppl. 81, *t. 45.*

Palawan, Victoria Peak, *Bur. Sci. 690 Foxworthy.*

13. **CALAMUS MANILLENSIS** H. Wendl. in Kerch. Les Palm. (1878) 237; Becc. in Rec. Bot. Surv. India 2 (1902) 215, Webbia 1 (1905) 349, Ann. Bot. Gard. Calcutta 11 (1908) 413, *t. 226, f. 1,* and Suppl. 98, *t. 55.*

Daemonorops manillensis Mart. Hist. Nat. Palm. 3: 330, *t. 175, VIII, f. 1–3;* Walp. Ann. 3 (1853) 480, 5 (1858) 829.

Luzon, "Manilla," *Gaudichaud* in Herb. Delessert: Nueva Vizcaya Province, Dupax, *Bur. Sci. 18994 McGregor.* Mindanao, Davao District, Mount Apo, *Elmer 11714, 10560:* Agusan Province, Mount Urdaneta, *Elmer 14133, 14011, 14173.*

14. **CALAMUS TRISPERMUS** Becc. in Perk. Fragm. Fl. Philip. (1904) 46, Ann. Bot. Gard. Calcutta 11 (1908) 412, *t. 180,* and Suppl. 97, Webbia 1 (1905) 349.

Luzon, Rizal Province, Antipolo, *Merrill 1645;* Montalban, *Loher 7071* in Herb. Kew.

15. **CALAMUS ARUGDA** Becc. in Philip. Journ. Sci. 4 (1909) Bot. 622, Ann. Bot. Gard. Calcutta 11: Suppl. 90, *t. 50.*

Luzon, Cagayan Province, Lalloc, *For. Bur. 6649 Klemme.*

16. **CALAMUS VINOSUS** Becc. in Leafl. Philip. Bot. MS.

Mindanao, Agusan Province, Mount Urdaneta, *Elmer 14158.*

A well-characterized species, resembling *C. multinervis,* but offering the very uncommon characters of two female flowers at every spathel with a neuter one interposed, and the wine red color of the ripe fruits.

17. **CALAMUS MOSELEYANUS** Becc. in Record Bot. Surv. Ind. 2 (1902) 211, Ann. Bot. Gard. Calcutta 11 (1908) 396, *t. 171,* and Suppl. 82, Webbia 1 (1905) 348.

Malanipa near Basilan, *Moseley* in Herb. Kew. Mindanao, Zamboanga District, San Ramon, *Hallier:* Davao District, Mount Apo, *Elmer 11886.*

18. **CALAMUS MINDORENSIS** Becc. in Ann. Bot. Gard. Calcutta 11: Suppl. 82, *t. 46.*

Mindoro, Balete, on Baco River, *McGregor 309, For. Bur. 6217 Merritt,* local name *tumalin.*

19. **CALAMUS MULTINERVIS** Becc. Ann. Bot. Gard. Calcutta 11: Suppl. 88, *t. 49.*

Mindanao, Davao District, Mount Apo, *Elmer 11955* (male plant), Bagobo name *balala;* and in the same district, south of the Baruring River, *Elmer 11791* (specimen with young fruits), Bagobo name *ubbli.*

20. **CALAMUS GRANDIFOLIUS** Becc. in Philip. Journ. Sci. 4 (1909) Bot. 629, Ann. Bot. Gard. Calcutta 11: Suppl. 94, *t. 53.*

Luzon, Laguna Province, Mount Banahao, *Loher 7088* in Herb. Kew.: Tayabas Province, Infanta, *Bur. Sci. 9448 Robinson.*

21. **CALAMUS JENNINGSIANUS** Becc. in Philip. Journ. Sci. 4 (1909) Bot. 623, Ann. Bot. Gard. Calcutta 11: Suppl. 91, *t. 51.*

Mindoro, Mount Halcon, *For. Bur. 4400 Merritt.*

22. **CALAMUS SAMIAN** Becc. Ann. Bot. Gard. Calcutta 11: Suppl. 92, *t. 52.*

Mindanao, Davao District, Mount Apo, *Elmer 11336*, Bagobo name *samian.*

23. **CALAMUS MEGAPHYLLUS** Becc. in Ann. Bot. Gard. Calcutta 11: Suppl. 66, *t. 35.*

Mindanao, Davao District, Mount Apo, *Elmer 11878:* Agusan Province, Mount Urdaneta, *Elmer 13542.*

24. **CALAMUS ELMERIANUS** Becc. in Leafl. Philip. Bot. 2 (1909) 647, Ann. Bot. Gard. Calcutta 11: Suppl. 69, *t. 37.*

Luzon, Tayabas Province, Lucban, *Elmer 9298* (type specimen). Mindanao, Davao District, Mount Apo, *Elmer 11756;* Agusan Province, Mount Urdaneta, *Elmer 14166;* Agusan River, *Merrill 7289.* (The Mindanao plant perhaps represents a distinct variety.)

25. **CALAMUS MITIS** Becc. in Philip. Journ. Sci. 3 (1908) Bot. 341, Ann. Bot. Gard. Calcutta 11: Suppl. 68, *t. 36.*

Batan Islands, Batan, *Bur. Sci. 3817 Fénix.*

26. **CALAMUS REYESIANUS** Becc. in Philip. Journ. Sci. 2 (1907) Bot. 237, Ann. Bot. Gard. Calcutta 11: Suppl. 86, *t. 48.*

Luzon, Tayabas Province, Unisan, *Reyes;* Tagcauayan, *Bur. Sci. 13312 Ramos.*

Probably a sterile specimen collected by *Hutchinson, For. Bur. 6105*, in Basilan Island is referable to this species.

27. **CALAMUS SPINIFOLIUS** Becc. in Rec. Bot. Surv. Ind. 2 (1902) 202, Ann. Bot. Gard. Calcutta 11 (1908) 410, *t. 178, 179*, Suppl. 95, Webbia 1 (1905) 348.

Panay, Iloilo Province, Igbaras, *Vidal 3954* in Herb. Kew. and Beccari (sterile specimen). Luzon, Pampanga Province, Arayat, *Loher 1373*, Herb. Kew., *Garcia 59*, local name *curacling* (sterile): Bataan Province, *For. Bur. 17309 Curran* (male specimen), *For. Bur. 1454 Ahern's collector* (fruiting specimen), *For. Bur. 20947 De Leon.*

28. **CALAMUS VIRIDISSIMUS** Becc. Ann. Bot. Gard. Calcutta 11: Suppl. 84, *t. 47.*

Mindanao, Davao District, Mount Apo, *Elmer 11938*, Bagobo name, *acal.*

Probably the following sterile specimens also belong to *C. viridissimus:* Mindanao, Zamboanga District, *For. Bur. 4820, 5180 Hutchinson.*

29. **CALAMUS MICROSPHAERION** Becc. in Perk. Fragm. Fl. Philip. (1904) 45, Webbia 1 (1905) 349, Ann. Bot. Gard. Calcutta 11 (1908) 543, *t. 204*, and Suppl. 113.

Culion, Halsey Harbor, *Merrill 507.*

Apparently a sterile specimen collected by *Hutchinson* in Mindanao, *For. Bur. 4818*, also belongs to this species. In this specimen the sheathed stem is only 8 to 9 mm in diameter, and the sheaths are provided with some very small, scattered, tuberculiform spines.

CALAMUS MICROSPHAERION Becc. var. **SPINOSIOR** Becc. var. nov.

Sheathed stem 2 to 3 cm in diameter; leaf-sheaths densely armed with scattered rather robust spines 5 to 12 mm long and having broad subbulbous bases. Leaflets bristly-spinulous on 1 to 3 costae above.

PALAWAN, Taytay, *Merrill 9358* (with ♂ flowers), *9247* (with fruits).

30. **CALAMUS RAMULOSUS** Becc. in Perk. Fragm. Fl. Philip. (1904) 46, Webbia 1 (1905) 349, in Ann. Bot. Gard. Calcutta 11 (1908) 454, *t. 205*.

LUZON, Tayabas Province, Guinayangan, *Merrill 2070*.

31. **CALAMUS VIDALIANUS** Becc. in Rec. Bot. Surv. Ind. 2 (1902) 212, Webbia 1 (1905) 350, Ann. Bot. Gard. Calcutta 11 (1908) 464, *t. 121*, and Suppl. 114, *t. 64*.

Calamus horrens ? Vidal Rev. Pl. Vasc. Filip. (1886) 280 (not of Blume).

LUZON, Tayabas Province, Unisan, *Vidal 933*, in Herb. Kew. (type specimen); Guinayangan, *Bur. Sci. 13214 Ramos* (♂ specimen in flower): Rizal Province, Montalban, *Loher 7087* in Herb. Kew., Tagalog *bogtong* (♀ specimen in flower): Bataan Province, *For. Bur. 20948 De Leon:* Nueva Ecija Province, *For. Bur. 22162 Alvarez* (♂).

32. **CALAMUS SIPHONOSPHATHUS** Mart. Hist. Nat. Palm. 3: 342; Walpers Ann. 3 (1853) 491, 5 (1858) 832; Miq. Fl. Ind. Bat. 3 (1855) 137; Becc. in Rec. Bot. Surv. Ind. 2 (1902) 213, Webbia 1 (1905) 350, Ann. Bot. Gard. Calcutta 11 (1908) 471, and Suppl. 115.

Calamus sp. Vidal Rev. Pl. Vasc. Filip. (1886) 330 (No. 931 and 1942).

Calamus siphonospathus is a very variable plant; it is, however, easily distinguishable by its spadices sheathed in gradually diminishing, subimbricate, loosely-tubular, subinflated spathes; by their dense and short, supradecompound, female inflorescences; and by the very small fruits. The inflated spathes of this *Calamus* are, apparently, ant-harboring organs.

CALAMUS SIPHONOSPATHUS Mart. forma **TYPICA** Becc. in Ann. Bot. Gard. Calcutta 11 (1908) 473.

LUZON, "Manila," *Perrottet* in Herb. Delessert: Rizal Province, Bosoboso, *Merrill 1891*, *Loher 1364* in Herb. Kew.; Montalban, *Loher 7089* in Herb. Kew. (♀) and *7077* (♂): Isabela Province, Cabagan River, *For. Bur. 18558 Alvarez* (♂), Negrito name *jusi*.

I am not quite sure that the sterile specimen, *Garcia 60*, mentioned in "Asiatic Palms" really is *C. siphonospathus.*

CALAMUS SIPHONOSPATHUS Mart. var. **SUBLAEVIS** Becc. in Webbia 1 (1905) 352, Ann. Bot. Gard. Calcutta 11 (1908) 474.

LUZON, Bataan Province, Lamao River, *Whitford 308, For. Bur. 1577 Borden, For. Bur. 2635 Meyer, For. Bur. 6225, 6514 Curran:* Ilocos Norte Province, Mount Piao, *For. Bur. 13985 Merritt & Darling.*

CALAMUS SIPHONOSPATHUS Mart. var. **FARINOSUS** Becc. Ann. Bot. Gard. Calcutta 11 (1908) 474.

LUZON, Rizal Province, Montalban, *Loher 7083* in Herb. Kew.

CALAMUS SIPHONOSPATHUS Mart. var. **OLIGOLEPIS** (*major*) Becc. in Webbia 1 (1905) 353, Ann. Bot. Gard. Calcutta 11 (1908) 475, *t. 215.*

Calamus inflatus Warb. in Herb. Berol.; Becc. in Perk. Fragm. Fl. Philip. (1904) 45.

LUZON, Tayabas Province, Sampaloc, *Warburg* in Herb. Berol.

CALAMUS SIPHONOSPATHUS Mart. var. **OLIGOLEPIS** (*minor*) Becc. in Webbia 1 (1905) 353, Ann. Bot. Gard. Calcutta 11 (1908) 476, *t. 217.*

LUZON, Isabela Province, Malunu, *Warburg* in Herb. Berol.

CALAMUS SIPHONOSPATHUS Mart. var. **BATANENSIS** Becc. in Philip. Journ. Sci. 3 (1908) 342, Bot. Ann. Gard. Calcutta 11: Suppl. 115.

BATAN ISLANDS, Batan, *Bur. Sci. 3611 Fénix.*

33. **CALAMUS DIMORPHACANTHUS** Becc. in Rec. Bot. Surv. Ind. 2 (1902) 214, Ann. Bot. Gard. Calcutta 11 (1908) 479 *t. 219*, Suppl. 117, Philip. Journ. Sci. 4 (1909) Bot. 631.

PANAY, Iloilo Province, Igbaras, *Vidal 3956,* in Herb. Becc. and Kew., local name *taguiti.* LUZON, Union Province, *Loher 1371* in Herb. Kew.: Benguet Subprovince, *Loher 1370* in Herb. Kew.; Mount Santo Tomas, *Elmer 6238.*

Perhaps a variety of this species is *Bur. Sci. 20559 Ramos,* from San Antonio, Laguna Province, with ♂ flowers; the leaflets are very inequidistant and have three nerves covered with bristly spinules above, and the midrib minutely spinulous underneath.

CALAMUS DIMORPHACANTHUS Becc. var. **MONTALBANICUS** Becc. in Philip. Journ. Sci. 4 (1909) Bot. 631, Ann. Bot. Gard. Calcutta 11: Suppl. 117, *t. 118.*

LUZON, Rizal Province, Montalban, Mount Batay, *Loher 7085* in Herb. Kew.

CALAMUS DIMORPHACANTHUS Becc. var. **ZAMBALENSIS** Becc. in Philip. Journ. Sci. 4 (1909) Bot. 632, Ann. Bot. Gard. Calcutta 11: Suppl. 118.

LUZON, Zambales Province, *For. Bur. 8412 Curran & Merritt.*

34. **CALAMUS MICROCARPUS** Becc. in Rec. Bot. Surv. Ind. 2 (1902) 213, Webbia 1 (1905) 355, Ann. Bot. Gard. Calcutta 11 (1908) 477, *t. 218*, and Suppl. 116, Philip. Journ. Sci. 4 (1909) Bot. 627, 6 (1911) Bot. 230.

LUZÓN, Camarines Province, *Vidal 3952* in Herb. Becc. and Kew.: Rizal Province, Montalban, *Loher* in Herb. Kew.: Laguna Province, Mount Maquiling, *For. Bur. 13305 Tamesis, For. Bur. 20668 Villamil:* Tayabas Province, *Bur. Sci. 12326 Foxworthy.* MINDANAO, Lanao District, Lake Lanao, *Mrs. Clemens 1232:* Agusan Province, Cabadbaran, *Elmer 13551:* Davao District, Todaya, Mount Apo, *Elmer 10676.* POLILLO, *Bur. Sci. 9131 Robinson, Bur. Sci. 10465 McGregor.*

Apparently a specimen with male spadices, from Abulug River, Cagayan Province, Luzon, *For. Bur. 11625 Fischer* also belongs to *C. microcarpus.*

CALAMUS MICROCARPUS Becc. var. **DIMINUTUS** Becc. var. nov.

Very slender, sheathed stem 8 to 10 mm in diameter. Leaves with very narrowly linear, very long-acuminate, very inequidistant, and more or less distantly grouped leaflets, the latter 4 to 5 mm wide. Spadix very short. Fruit globular, 8 mm in diameter.

LUZON, Laguna Province, San Antonio, *Bur. Sci. 16599 Ramos.*

I am uncertain if we have to do with a case of occasional slenderness of *Calamus microcarpus* or with a really distinct and constant variety or even a subspecies of it. Very similar to the preceding specimen is another, which is a little larger and with a male spadix. The sheathed stem is 11 mm in diameter; the leaflets are 5 to 6 mm wide. Kabibihan, Tayabas Province. *Bur. Sci. 13240 Ramos.*

35. **CALAMUS HALCONENSIS** Becc. in Philip. Journ. Sci. 4 (1909) Bot. 633, Ann. Bot. Gard. Calcutta 11: Suppl. 116, *t. 65.*

MINDORO, Mount Halcon, *For. Bur. 4399 Merritt.*

36. **CALAMUS BICOLOR** Becc. in Ann. Bot. Gard. Calcutta 11. Suppl. 126, *t. 73.*

MINDANAO, Davao District, Mount Calelan, Mount Apo, *Elmer 10618, 10541,* Bagobo names *sambonotan* and *lassee* or *rassee.*

DAEMONOROPS Blume

Conspectus of the species.

a^1. *Cymbospatha.* Spadix, ♂ and ♀, contracted. Primary spathes cymbiform, beaked, the outermost completely inclosing the inner ones.
1. *D. Margaritae* var. *palawanicus.*

a^2. *Piptospatha.* Spadix, ♂ and ♀, elongated. Inner primary spathes gradually longer than the outermost.

b^1. Leaflets very inequidistant, ensiform, the largest 40 to 50 cm long, 2.5 to 3 cm wide; fruit ovoid-ellipsoidal, 25 mm long, 16 to 17 mm thick, very shortly pedicellate.. 2. *D. virescens.*

b^2. Leaflets equidistant.

c^1. The mouths of the leaf sheaths unarmed.

d^1. Leaflets lanceolate-ensiform, the largest 30 to 45 cm long, 3 to 3.5 cm wide, the midrib only sparsely bristly below, smooth above or else minutely spinulous near the apex; fruit spherical, mammillate-beaked, 18 to 20 mm in diameter..... 3. *D. ochrolepis.*

d^2. Leaflets less than 3 cm wide, bristly on three to five nerves above.

e^1. Leaflets 30 cm long, 15 to 16 mm wide (the largest), bristly on three nerves above, and on the midrib only underneath; the axis of the spadix and spikelets coated with a rusty-brown scurf; fruit carried on a pedicel 8 to 10 mm long, globose-ovoid, obtusely mammillate-beaked.
4. *D. urdanetanus.*

e^2. Leaflets very narrowly lanceolate, 20 to 23 cm long, 14 to 18 mm wide (the largest), bristly on three nerves above, and with a few long bristles on the midrib only underneath. Male flowers very long and slender (12 mm long).
5. *D. Loherianus.*

e^3. Leaflets 30 cm long, 15 to 20 mm wide (the largest), bristly on five nerves above, but only on the midrib beneath, fruit 12 to 17 mm long, 9 to 11 mm through, ovoid-ellipsoid, carried on a pedicel 4 to 6 mm long............................ 6. *D. pedicellaris.*

d^3. Leaflets less than 3 cm wide, having the midrib alone spinulous, on only one or on both surfaces.

e^1. Leaflets 30 to 32 cm long, 2 to 2.5 cm wide (the largest), having the midrib alone spinulous on both surfaces; axis of the spadix and spikelets densely coated with a copious brown felt; fruit ovoid-ellipsoid, blunt-mammillate, carried on a thick, 5 to 6 mm long pedicel............................ 7. *D. pannosus.*

e^2. Leaflets 30 to 40 cm long, 2 to 2.5 cm wide (the largest), smooth or nearly so on the upper surface, underneath the midrib alone remotely spinulous; axial parts of the spadix and spikelets coated with adherent rusty-brown scurf; fruit globose and obtusely mammillate, 17 to 18 mm in diameter, with a few well-conformed scales, and carried on a pedicel 10 to 12 mm long.. 8. *D. oligolepis.*

c^2. The mouths of the leaf-sheaths armed with erect spines, longer than those on the body.

d^1. Fruit large, over 2 cm in diameter; leaflets narrowly ensiform, 40 to 42 cm long, 13 to 15 mm broad (the largest), spinulous on three nerves above and bristly on the midrib alone beneath; fruit spherical, 20 to 24 mm in diameter.... 9. *D. Clemensianus.*

d^2. Fruit less than 2 cm in diameter.

e^1. Leaflets linear-ensiform, 35 to 45 cm long, 16 to 24 mm broad (the largest), with three bristly nerves on the upper surface, underneath the midrib alone or, occasionally, also three nerves bristly; partial inflorescences and spikelets spreading; fruit globose, mammillate-beaked, often slightly depressed, 15 to 18 mm in diameter.................................... 10. *D. Gaudichaudii.*

e^2. Leaflets narrowly ensiform, 55 to 60 cm long, 20 to 22 mm broad (the largest), almost smooth above and with only a few short bristles on the midrib underneath; partial in-

florescences and spikelets inserted at a very acute angle; fruit globose, conically beaked, 12 mm in diameter.
11. *D. affinis.*

e^3. Leaflets lanceolate-ensiform, 33 to 40 cm long, 17 to 20 mm broad, bristly on three to five nerves on the upper surface and on the midrib alone underneath; spikelets spreading; fruit globular or shortly ovoid, minutely beaked, 12 mm in diameter.. 12. *D. Curranii.*

e^4. Leaflets linear-lanceolate, 25 to 28 cm long, 12 to 14 mm broad (the largest), sparingly spinulous on three nerves above and underneath with only a few bristles on the midrib from the middle upward; fruit small, broadly ovoid-ellipsoid, 12 mm long, 9 mm thick. A slender plant, sheathed stem 12 to 15 mm in diameter.. 13. *D. gracilis.*

1. **DAEMONOROPS MARGARITAE** Becc. var. **PALAWANICUS** Becc. Ann. Bot. Gard. Calcutta 12 (1912) 57, *t. 10.*

PALAWAN, *Bur. Sci. 899 Foxworthy;* Taytay, *Merrill 9359;* Puerto Princesa, *Elmer 12943.*

2. **DAEMONOROPS VIRESCENS** Becc. in Perk. Fragm. Fl. Philip. (1904) 47, Webbia 1 (1905) 357, Ann. Bot. Gard. Calcutta 12 (1912) 201, *t. 91.*

PALAWAN, San Antonio Bay, *Merrill 868.*

3. **DAEMONOROPS OCHROLEPIS** Becc. in Perk. Fragm. Fl. Philip. (1904) 47, Webbia 1 (1905) 356, Ann. Bot. Gard. Calcutta 12 (1912) 160, *t. 65,* Philip. Journ. Sci. 6 (1911) Bot. 230.

Daemonorops ochrolepis var. *radulosus* Becc. in Ann. Bot. Gard. Calcutta 12 (1912) 162, *t. 66.*

LUZON, Tayabas Province, Guinayangan, *Merrill 2069;* Kabibihan, *Bur. Sci. 13101 Foxworthy & Ramos, Bur. Sci. 13235 Ramos,* local name *palanog* (♂), *For. Bur. 10190 Curran:* Rizal Province, *Loher 1365,* in Herb. Kew.; Siya Bundoc, *Loher 7078* in Herb. Kew.: Nueva Ecija Province, *For. Bur. 8490 Curran.* POLILLO, *Bur. Sci. 9039 Robinson.* MINDANAO, Lanao District, Camp Keithley, *Mary Strong Clemens 898:* Agusan Province, Mount Urdaneta, *Elmer 14120:* Davao District, Mount Apo, *Elmer 11875.*

The variety *radulosus,* after the inspection of more complete material, can hardly be considered as distinct. The plant from Mindanao differs from that of Luzon and Polillo by its somewhat smaller fruits.

4. **DAEMONOROPS URDANETANUS** Becc. in Elm. Leafl. Philip. Bot. MS.

MINDANAO, Agusan Province, Mount Urdaneta, *Elmer 14201.*

5. **DAEMONOROPS LOHERIANUS** Becc. in Ann. Bot. Gard. Calcutta 12 (1912) 104, *t. 41.*

LUZON, Rizal Province, Siya Bundoc, *Loher 7078* in Herb. Kew.

6. **DAEMONOROPS PEDICELLARIS** Becc. in Elmer Leafl. Philip. Bot. MS.

MINDANAO, Davao District, Mount Apo, *Elmer 11896:* Agusan Province, Mount Urdaneta, *Elmer 13853, 14132:* Lanao District, Camp Keithley, *Mary Strong Clemens 1280.*

7. **DAEMONOROPS PANNOSUS** Becc. in Elm. Leafl. Philip. Bot. MS.
MINDANAO, Davao District, Mount Apo, *Elmer 11600.*

8. **DAEMONOROPS OLIGOLEPIS** Becc. in Elm. Leafl. Philip. Bot. MS.
MINDANAO, Davao District, Mount Apo, *Elmer 11757.*

9. ? **DAEMONOROPS CLEMENSIANUS** Becc. in Ann. Bot. Gard. Calcutta 12 (1912) 163, *t. 67.*

MINDANAO, Lanao District, Camp Keithley, *Mary Strong Clemens 1227.*

The fruit of *Daemonorops Clemensianus* is so much like that of *D. ochrolepis*, that I have a suspicion that the portion of leaf attributed to the first plant and reproduced in the quoted plate as such, is not its own, but that of a different species; consequently, *D. Clemensianus* is for the present to be regarded as a doubtful species.

10. **DAEMONOROPS GAUDICHAUDII** Mart. Hist. Nat. Palm. 3 (1849) 331; Becc. Ann. Bot. Gard. Calcutta 12 (1912) 157, *t. 64*, Perk. Fragm. Fl. Philip. (1904) 47, Webbia 1 (1905) 365, Philip. Journ. Sci. 3 (1908) Bot. 342.

LUZON, Rizal Province, Montalban, *Loher 7072, 7086* in Herb. Kew.; Bosoboso, *Bur. Sci. 1212 Ramos:* Nueva Ecija Province, Dupax, *Bur. Sci. 11358, 14192 McGregor, For. Bur. 22163 Alvarez:* Tayabas Province, Guinayangan, *Hagger 25;* Unisan, *Vidal 4063* in Herb. Becc.; Sampaloc, *Warburg* in Herb. Berol.: Bataan Province, Mount Mariveles, *For. Bur. 17310 Curran, For. Bur. 2601 Meyer:* Camarines Province, *For. Bur. 21713 Abellanosa:* province not indicated, *Langlassé 141* in Herb. de Candolle. NEGROS, *For. Bur. 20892 Tamesis.* MINDORO, Bongabong River, *Whitford 1371, For. Bur. 3741 Merritt;* Calapan, *Bur. Sci. 948 Mangubat.* SIBUYAN, *Elmer 12494.* BABUYAN ISLANDS, Camiguin, *Bur. Sci. 4066 Fénix.* MINDANAO, Surigao Province, *Bolster 353:* Davao District, Mount Apo, *Elmer 11880.*

11. **DAEMONOROPS AFFINIS** Becc. in Elm. Leafl. Philip. Bot. MS.
MINDANAO, Agusan Province, Mount Urdaneta, *Elmer 13978.*

12. **DAEMONOROPS CURRANII** Becc. in Philip. Journ. Sci. 2 (1907) Bot. 238, Ann. Bot. Gard. Calcutta 12 (1912) 142 (exclusive of the portion of leaf-sheath and the fragment of the spadix on the left side of that plate, as these parts really belong to *D. pedicellaris* Becc., *Clemens 1280*).

PALAWAN, *For. Bur. 3791 Curran;* Brooke's Point, *Elmer 12663.*

13. **DAEMONOROPS GRACILIS** Becc. in Elm. Leafl. Philip. Bot. MS.
PALAWAN, Puerto Princesa, Mount Pulgar, *Elmer 12945.*

ILLUSTRATIONS

[In all of the plates the fruits and seeds are natural size, and the male flowers are enlarged 7 diameters. All the figures are reproduced from camera-lucida drawings by the author.]

PLATE I

FIG. 1. *Areca Catechu* Linn. (*semisilvatica*). Vertical section of a fruit, preserved in alcohol, collected by L. S. Gibbs in a semiwild condition at Tuaran at the foot of Mount Kinabalu in British North Borneo. This and Plate II, figure 1, although not presenting Philippine specimens, are here given to show the commonest Malayan forms of the fruits of *A. Catechu*, for comparison with the Philippine ones.

2. *Areca Catechu* Linn. var. *silvatica* Becc.; *a*, fruit entire; *b*, vertical section of the fruit, showing one side of the seed, entire, in situ; *c*, vertical section of the seed; *d*, *e*, male flowers; *f*, section of a male flower, showing one petal and its respective two stamens and the rudimentary ovary. From *Merrill 9447*, collected in Palawan.

3. *Areca Catechu* Linn. (forma *communis*); *a*, vertical section of the fruit, showing one side of the seed, entire, in situ (from a specimen collected at Lucban, Luzon, *Elmer 9295* in Herb. Beccari); *b*, male flower; *c*, section of a male flower, showing one petal with its respective two stamens, and the rudimentary ovary (from *Mearns & Hutchinson 4717*, collected in Mindanao).

PLATE II

FIG. 1. *Areca Catechu* L. var. *alba* Bl.; *a*, vertical section of the fruit, showing one side of the seed, entire, in situ; *b*, male flower; *c*, section of a male flower, showing one petal with its respective two stamens, and the rudimentary ovary. From a plant cultivated in the botanic garden at Buitenzorg.

2. *Areca Catechu* L. var. *longicarpa* Becc.; *a*, vertical section of the fruit, showing one side of the seed in situ; *b*, a male flower; *c*, section of a male flower showing one petal with its respective two stamens, and the rudimentary ovary. From *McGregor 10470*, collected in Polillo.

3. *Areca Catechu* L. var. *portoricensis* Becc.; *a*, vertical section of the fruit; *b*, male flower; *c*, section of a male flower showing one petal with its respective two stamens, and the rudimentary ovary. From *Sintenis 5749* in the Berlin Herbarium.

I have given here a figure of the fruit of this very anomalous American variety of *Areca Catechu*, because of its great resemblance to the fruit of the Philippine *A. macrocarpa* and of the variety *longicarpa* of *A. Catechu*. The figure is drawn from *Sintenis 5749* from plants cultivated near houses in the vicinity of Aquadilla, Porto Rico; which specimens have been referred by

Urban in his "Symbolae" 4 (1903) 130 to *Areca Catechu* Linn. Notwithstanding the unusual form of the fruit of the var. *portoricensis*, there is no doubt about its belonging to *Areca Catechu* (in a wide sense), as the fruiting specimen is accompanied by spadices having female and male flowers. The male flowers are furnished with six stamens and conspicuous, 3-pointed, rudimentary ovary; the male flowers of the American plant not differing in that respect, in the slightest particulars, from those of the common *A. Catechu* of the Orient. As to the origin of this American variety the hypothesis of its direct importation into the New World from the Orient cannot be absolutely discarded, but I would observe that among the innumerable individuals of *Areca Catechu* seen by me in the regions where that palm grows profusely, and where it presents numerous varieties, I have not seen a single plant having fruits approaching in shape to those of var. *portoricensis*, nor have I found any such plant mentioned in botanical works. However, the general shape of the fruit of *A. Catechu* var. *portoricensis* is so much like that of *A. Catechu* var. *longicarpa* and *A. macrocarpa*, both Philippine palms, that we are led to surmise that the American variety may have had a Philippine origin, even if it be not precisely identifiable with any of the actually known Philippine forms. Otherwise we may contemplate the possibility of the case of a sudden neogenesis, originated from changed ambient condition, during the acclimatization in the New World of a plant characteristic of the tropical regions of the Orient.

PLATE III

FIG. 1. *Areca parens* Becc.; *a*, vertical section of the fruit; *b*, seed, side view; *c*, *d*, male flowers; *e*, section of a male flower, showing a petal and three of its six stamens, with the small rudimentary ovary among them. From *Abellanosa 21712*.

2. *Areca macrocarpa* Becc.; *a*, vertical section of the fruit, showing the dorsal or raphal side of the seed, entire; *b*, seed, side view; *c*, seed, vertical section. From *Whitford and Hutchinson 9103*.

3. *Areca camarinensis* Becc.; *a*, vertical section of the fruit; *b*, seed, side view. From *Aguilar 14268*.

4. *Areca Ipot* Becc.; *a*, vertical section of the fruit; *b*, seed, side view. From *Elmer 9292* in Herb. Beccari.

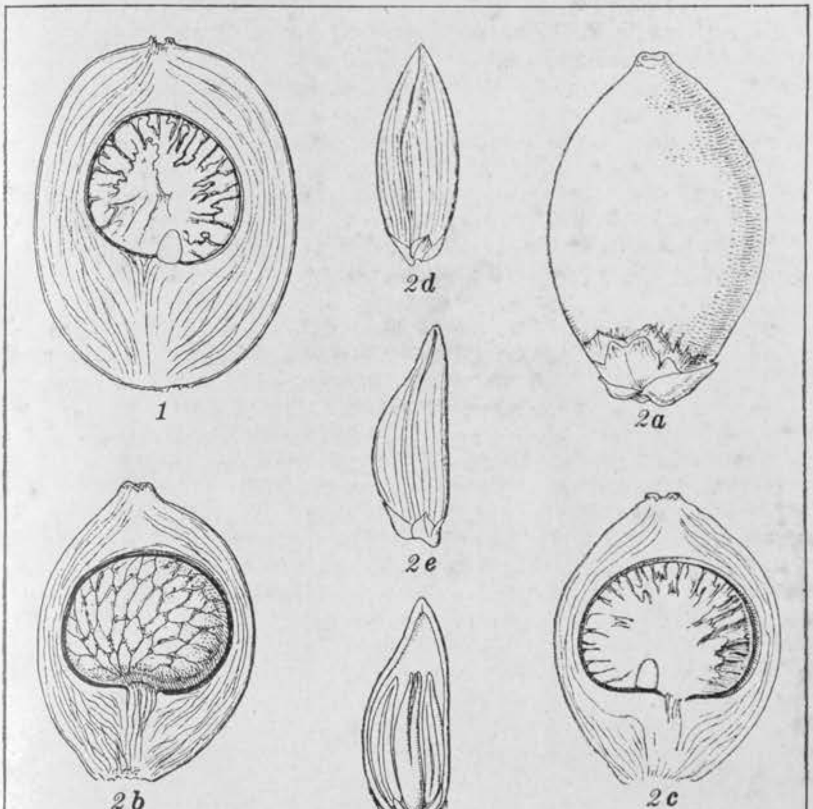

Fig. 1. Areca catechu (semisilvatica). 2. A. Catechu var. silvatica. 3. A. Catechu (communis).

PLATE I.

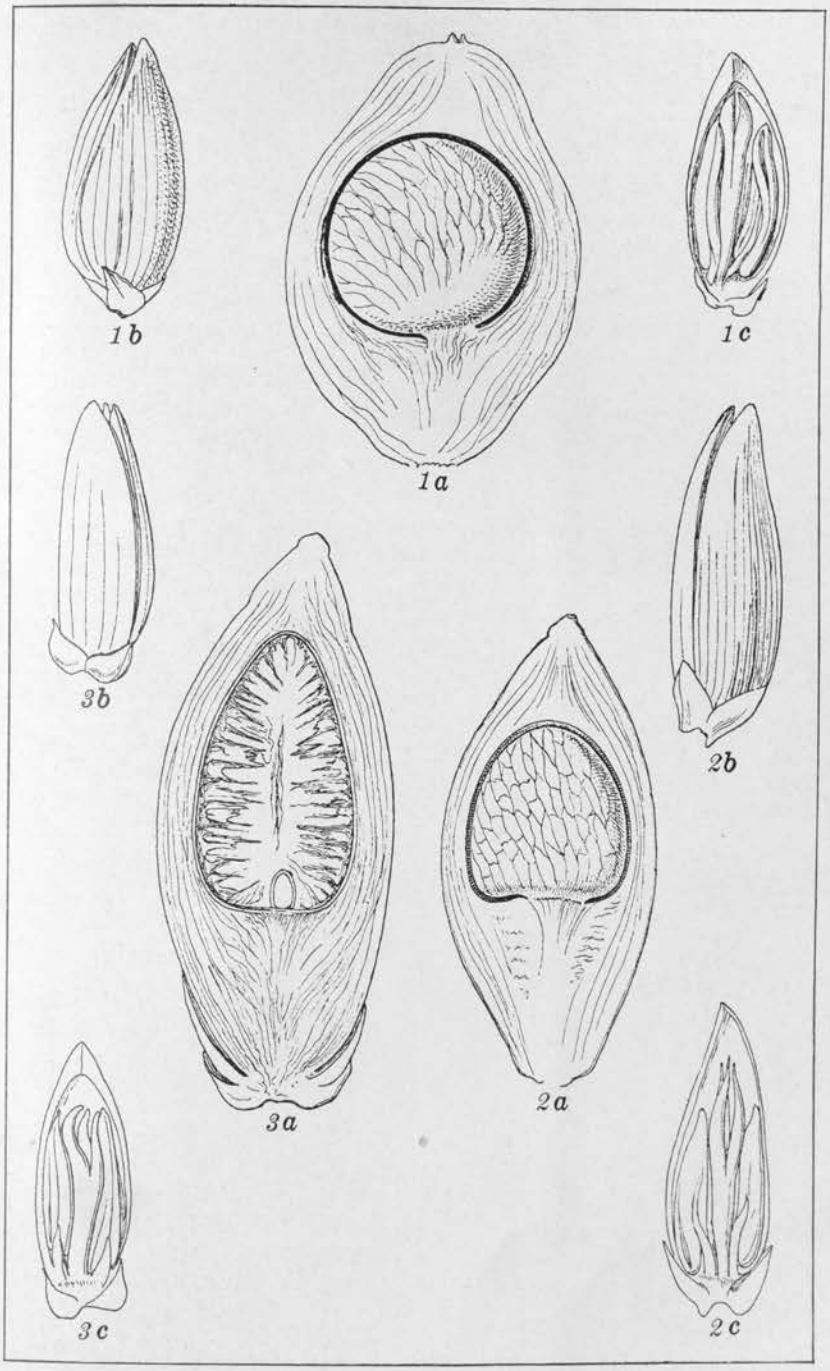

Fig. 1. Areca Catechu var. alba. 2. A. Catechu var. longicarpa. 3. A. Catechu var. portoricensis.

PLATE II.

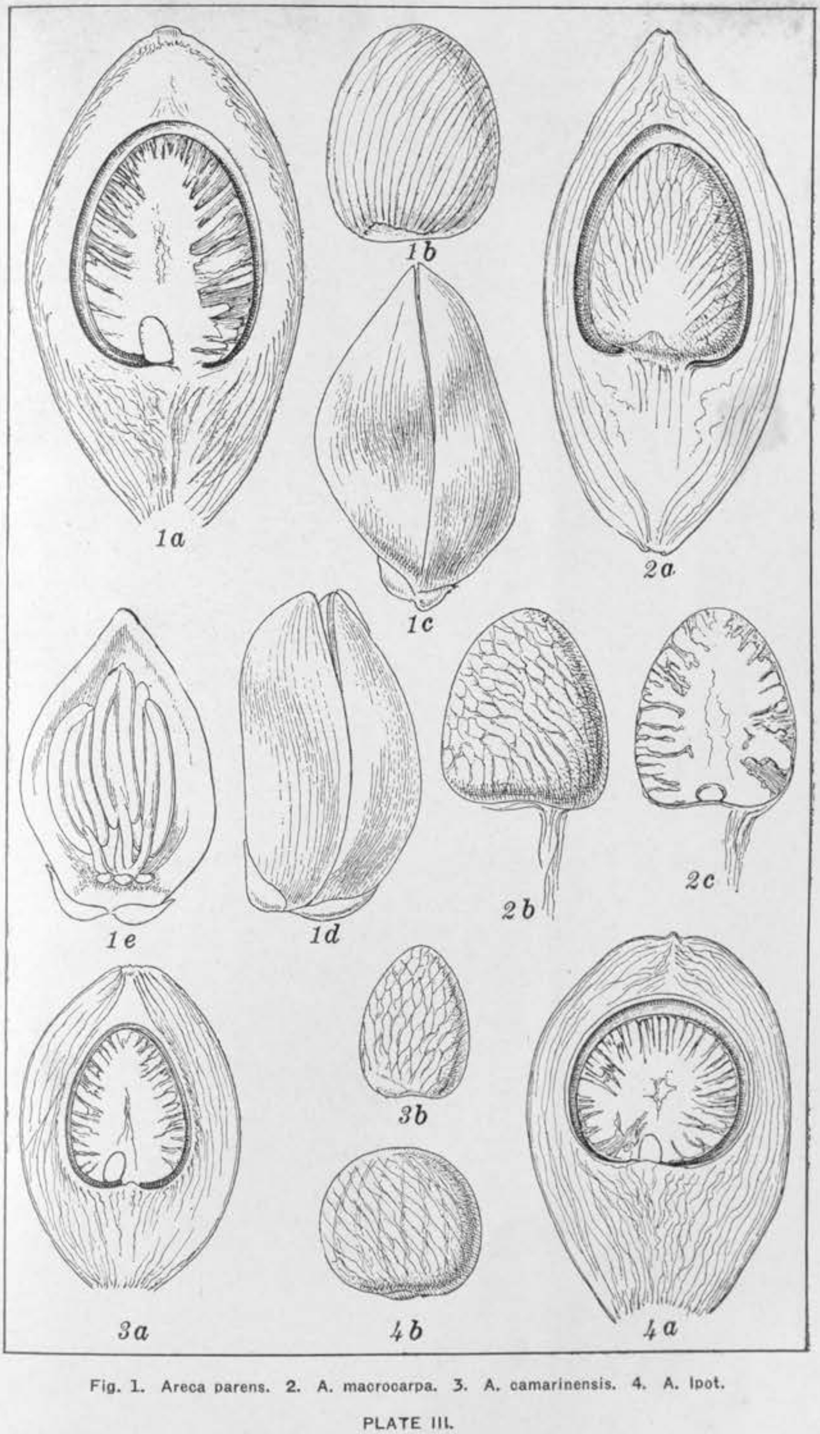

Fig. 1. Areca parens. 2. A. macrocarpa. 3. A. camarinensis. 4. A. Ipot.

PLATE III.

REVIEWS

The Treatment of | War Wounds | by | W. W. Keen, M. D., LL. D. | Major, Medical Reserve Corps, U. S. Army | emeritus professor of surgery | Jefferson Medical College, Philadelphia | second edition, reset | Philadelphia and London | W. B. Saunders Company | 1918. 434 pp., including index. Cloth, $4.

This little book of 276 pages is well written, and the subject is clearly presented. The author shows how this war differs widely, from a surgical standpoint, from all other wars in five principal respects, as follows:

1. The huge numbers in the armies and, therefore, of the wounded.
2. The new means of transportation.
3. The new weapons, especially in the artillery.
4. Rampant infections of wounds.
5. The conquest of infection by more efficient antiseptics and by new methods.

While it is essentially a book for army doctors, yet it is invaluable also for all men doing surgery as well as for general practitioners. The chapter on the Carrel-Dakin method of wound treatment is especially valuable as it goes minutely into the technic. The treatment of burns is not only up to date in technic but gives the formula for "No 7 Parraffin" of Lt. Col. A. J. Hull of the British Army, which he states is superior to the much talked of and advertised Amberine of Dr. Barthe de Sandfort, the preparing of which has been kept a secret in "absolute contravention of American Medical Ethics."

A. M. GIFFEN.

A Text-book of | General | Bacteriology | by | Edwin O. Jordan, Ph.D. | professor of bacteriology in the University of Chicago | and in Rush Medical College | fully illustrated | sixth edition, thoroughly revised | Philadelphia and London | W. B. Saunders Company | 1918. 691 pp. Cloth, $3.75 net.

FROM THE PREFACE

This book is the outgrowth of lectures given to students in the University of Chicago during the past few years. The subject is one that the writer believes should find a place in every general scientific course. Bacteriology is chiefly of professional interest to the medical student, but the subject also bears technical relations to household administration, to agriculture, to sanitation and sanitary engineering and to various industries and technological pursuits. For the general scientific student and reader bacteriology presents certain aspects that tend to widen the outlook upon a variety of human interests.

It need hardly be said that within the compass of this work an exhaustive treatment of all sides of bacteriology is impossible. The needs of the advanced worker can be met only—and that but in part—by such monumental special treatises as the Handbuch der Pathogenen Mikroörganismen, edited by Kolle and Wassermann, and the Technische Mykologie, edited by Lafar. A general introduction to the subject, however, with some regard for perspective and with emphasis on general rather than on special questions has seemed worth attempting.

The reader who wishes to acquire greater familiarity with the subject will find some bibliographical references given as a sort of first aid to the investigator. These include references to some articles of classic or historic interest, to some giving valuable summaries or bibliographies of important subjects and to a few in fields where investigation is very active or opinions considerably at variance. No pretension to completeness is made.

The fundamental principles and methods of laboratory work are treated as fully as seems desirable in a book of this class. The tendency manifested in all the natural sciences towards the elaboration of special laboratory manuals and guides has much in its favor. A number of such guides for bacteriology are in existence, among which may be mentioned the excellent manuals of Frost, Gorham, Heinemann, Moore and Novy, to mention only American authors. In any case a proper familiarity with laboratory methods can be gained only with the assistance of a skilled laboratory instructor possessed of individuality and resource.

FROM PREFACE TO THE SIXTH EDITION

In this edition the chapter on *The Pneumococcus* has been entirely rewritten and that on *The Meningococcus* extensively revised. Several new sections have been added, including brief summaries of our present knowledge of infectious jaundice, ratbite fever, and trench fever. A number of minor changes and corrections have also been made throughout the text.

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